ELECTRICAL CONSTRUCTION AND MAINTENANCE

AUGUST • 1949

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A McGRAW-HILL PUBLICATION

No conductors cut...

.. no interrupted service...

with New AF-2 LOAD VISUALIZER

MEASURES FROM 200 TO 1000 AMPERES WITHOUT CUTTING CONDUCTORS OR INTERRUPTING SERVICE (with split-core transformer). Volts, line amperes, and component amperes are measured directly. Handy calculator is provided for computing power factor, watts, and vars. The AF-2 is self-contained up to 50 amperes, and when used with the Type G-4 spit-core transformer that comes with it, the range can be extended to 1000 amperes.

The load visualizer, split-core transformer, calculator, and terminal leads come in an attractive, sturdy carrying case. Your nearest G.E. Representative will be glad to discuss specific applications with you. See him today. Or write for Bulletin GEC-372. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

many applications

Testing Motors
Checking power and lighting circuits
Checking transformers
Or analyzing *any* a-c load

measures

Voltage **Current**
Power Factor
Watts **Vars**

GENERAL ELECTRIC

602-111

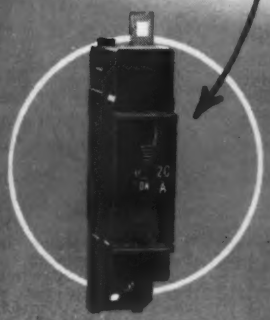
Murray
MODERN
METHODS *mean Highest Quality . . . Latest Design . . . Greatest Value!*

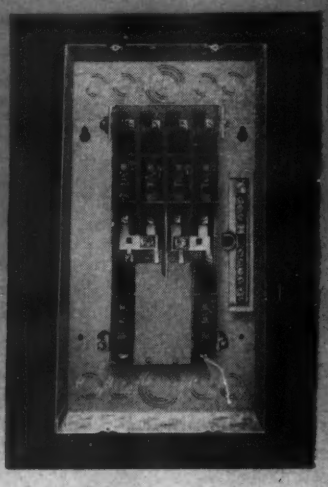
Listed by Underwriters' Laboratories, Inc.

8 Circuits *in* 1 Load Center

With the World's Most Satisfactory Overload Protection:

Murray FULLY MAGNETIC Circuit Breakers





Eight branch circuits are controlled and protected by this NEW Murray Magnetic Circuit Breaker Load Center. Utmost flexibility is achieved by *individually interchangeable* single pole breakers rated at 10 to 50 amp. Range Circuits can be accommodated by 35 or 50 amp. circuit breakers. Surface or flush mounting.

Now you can anticipate two of tomorrow's needs today: (1) more circuits, (2) better protection against overloads. Both requirements are met in the NEW Murray 8 Circuit Magnetic Breaker Load Center!

This modern new equipment brings you the latest in satisfactory overload protection — at moderate cost. As few as four breakers need be installed with the panel . . . more can be added as circuits are added! Any *individual* breaker can be interchanged with a breaker of different rating — making possible unlimited combinations, right on the job . . . and the only tool needed is a screwdriver!

In addition, each Murray *Fully Magnetic* Circuit Breaker is virtually an electrical engineer at the switch! Just see what it does: It carries full rated load indefinitely — *no derating necessary.* It accommodates heavy momentary overloads — even when carrying full rated current. Yet it trips reliably, in a reasonable time, under sustained overloads. It interrupts the circuit almost instantaneously under "short circuit" conditions. *And because it has no thermal element, it is virtually unaffected by ambient temperature changes!*

Yes, you can equip today for the loads of tomorrow — and for tomorrow's exacting standards of overload protection—with the NEW Murray 8 Circuit Magnetic Breaker Load Center. For full details, contact your Murray representative, or write

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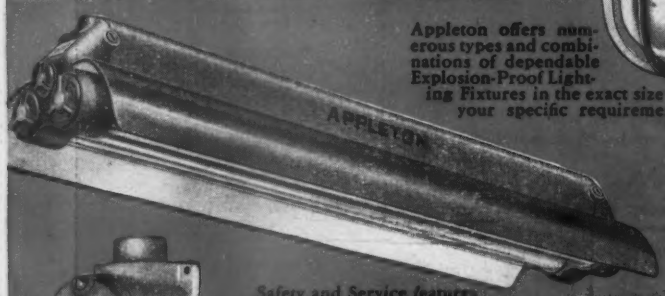
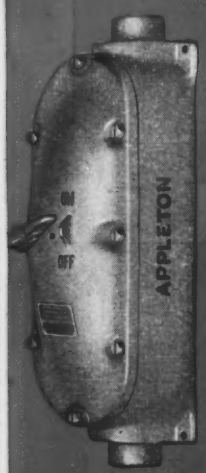
SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS' NEST AERIAL LADDERS

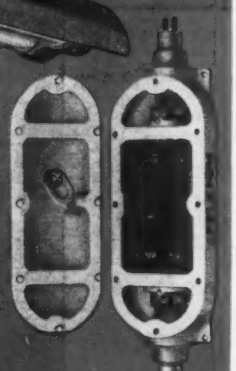
PERMANENT DISASTER PREVENTION!

Appleton offers numerous types and combinations of dependable Explosion-Proof Lighting Fixtures in the exact size for your specific requirements.



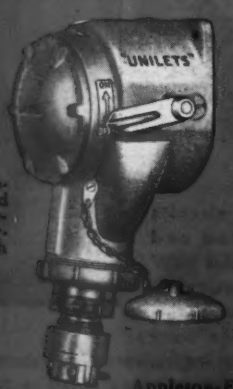


Safety and Service features of the Appleton Type EFU Explosion-Proof Fluorescent Lighting Fixtures make them foremost in design of fluorescent lighting for hazardous locations.



The Appleton Seal-Line Switch Unilet is a combination switch housing and sealing unit. Provides complete explosion-proof performance without the need of additional sealing fittings.

View of Appleton Seal-Line Switch Unilet with cover removed, showing switch chamber isolated from splicing chambers in approved explosion-proof method.



Type FSQX Explosion-Proof and Dust-Tight Receptacle with interlocking safety switch and type FP plug.

Appleton-Explosion-Proof Reelites automatically take up and pay out conductor cable to machinery used in hazardous locations.

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APPLETON
EXPLOSION-PROOF EQUIPMENT
For Hazardous Locations

Dangers to life and property that lurk in the wiring systems of hazardous locations are permanently eliminated when Appleton Explosion-Proof Equipment is used.

These rugged malleable iron conduit fittings and lighting fixtures confine treacherous arcs that cause fires and explosions in chemical plants, oil refineries, hospital surgeries—all locations where explosive or flamable vapors, dusts or gases are present.

Appleton Explosion-Proof Fittings are strong and unbreakable, roomy, truly threaded and machined, easy to install. And there is an Appleton Explosion-Proof Fitting exactly suited to every explosion-proof requirement.

Any wiring job—explosion-proof or otherwise—is a better wiring job when Appleton Electrical Fittings are used. So save time and build better. Order all your wiring requirements from one dependable source—the 15,000-Item Appleton Line. Write for catalog information.

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August • 1949

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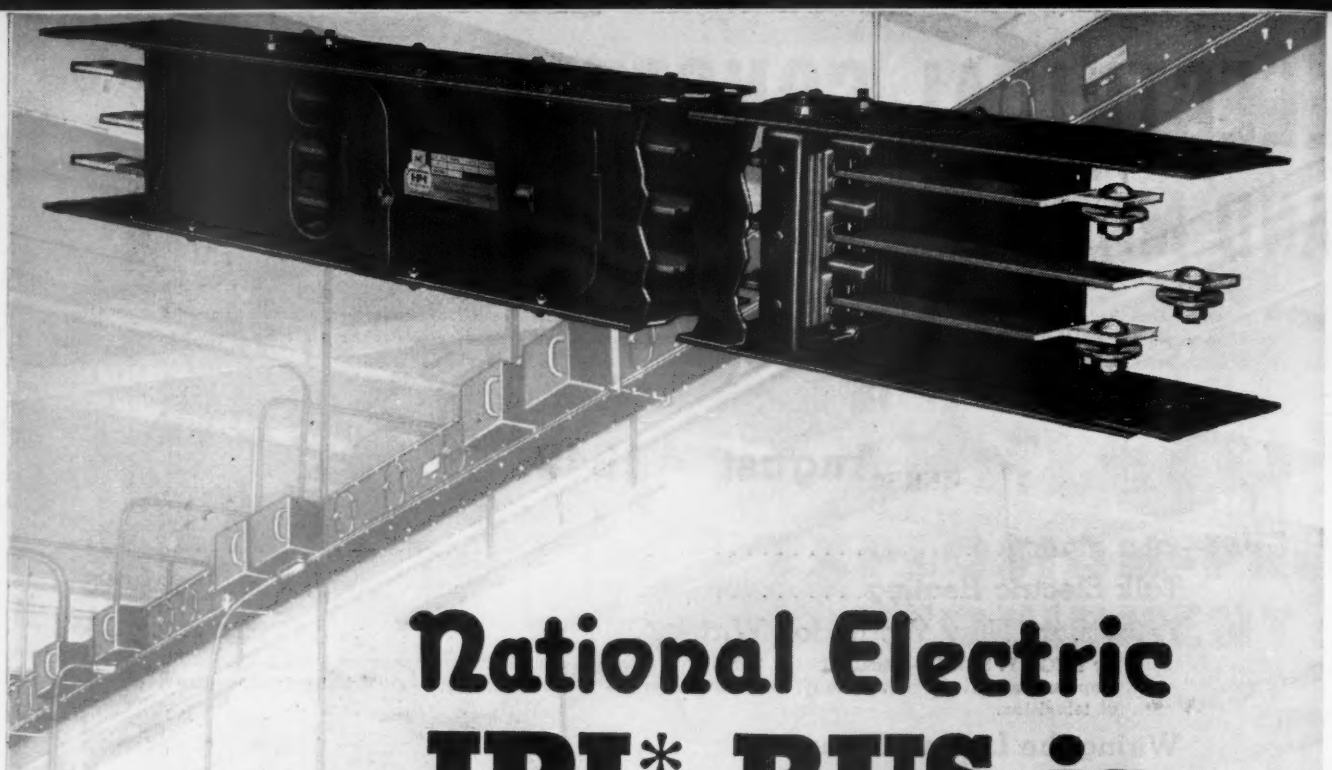

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CHECK THESE ADDITIONAL ADVANTAGES!

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National Electric Plug-In Busway can be used to bring your present electrical distribution system up to date, or can be added to existing installations.

Plug-In openings, spaced 15″ on center on two sides of Busway, permits mounting Plug-In Devices every 7½″.

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Busway can be mounted to permit installation of Plug-In Devices with standard ¼-20″ screws on either side, or top and bottom.

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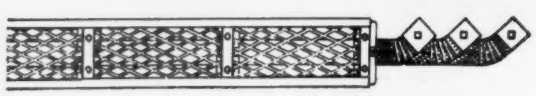
***National Electric's Industrial Plug-In Bus is a completely self-contained electrical distribution system designed for quick, *simple* installation. Insulator bolts extending through the enclosure make suspension from ceiling or walls an easy job.**

Approved by Underwriters' Laboratories, Inc.



"Lo-Loss" Feeder Bus—specifically designed for transmission of current up to 4000 amp. at 600 volts or less. National **"Lo-Loss"** will do it economically and efficiently. Light in weight—compact in design. Easily installed because single bolt contacts are used.

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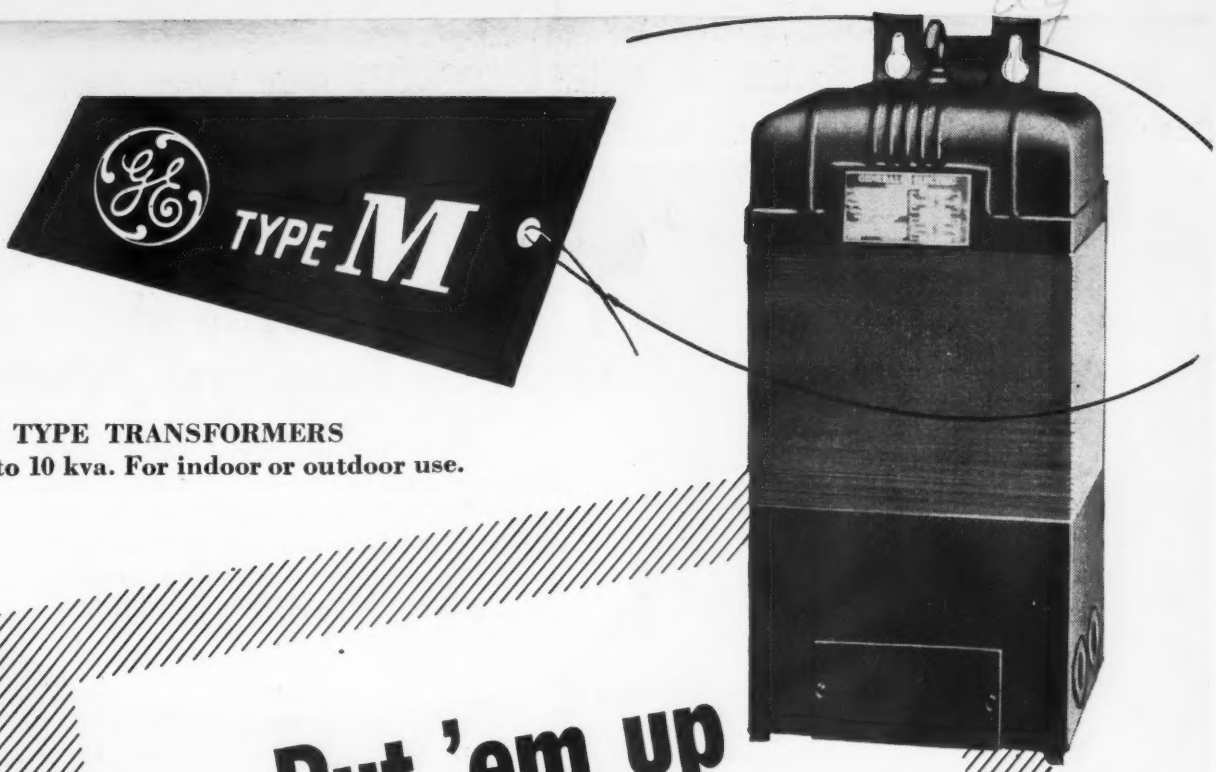

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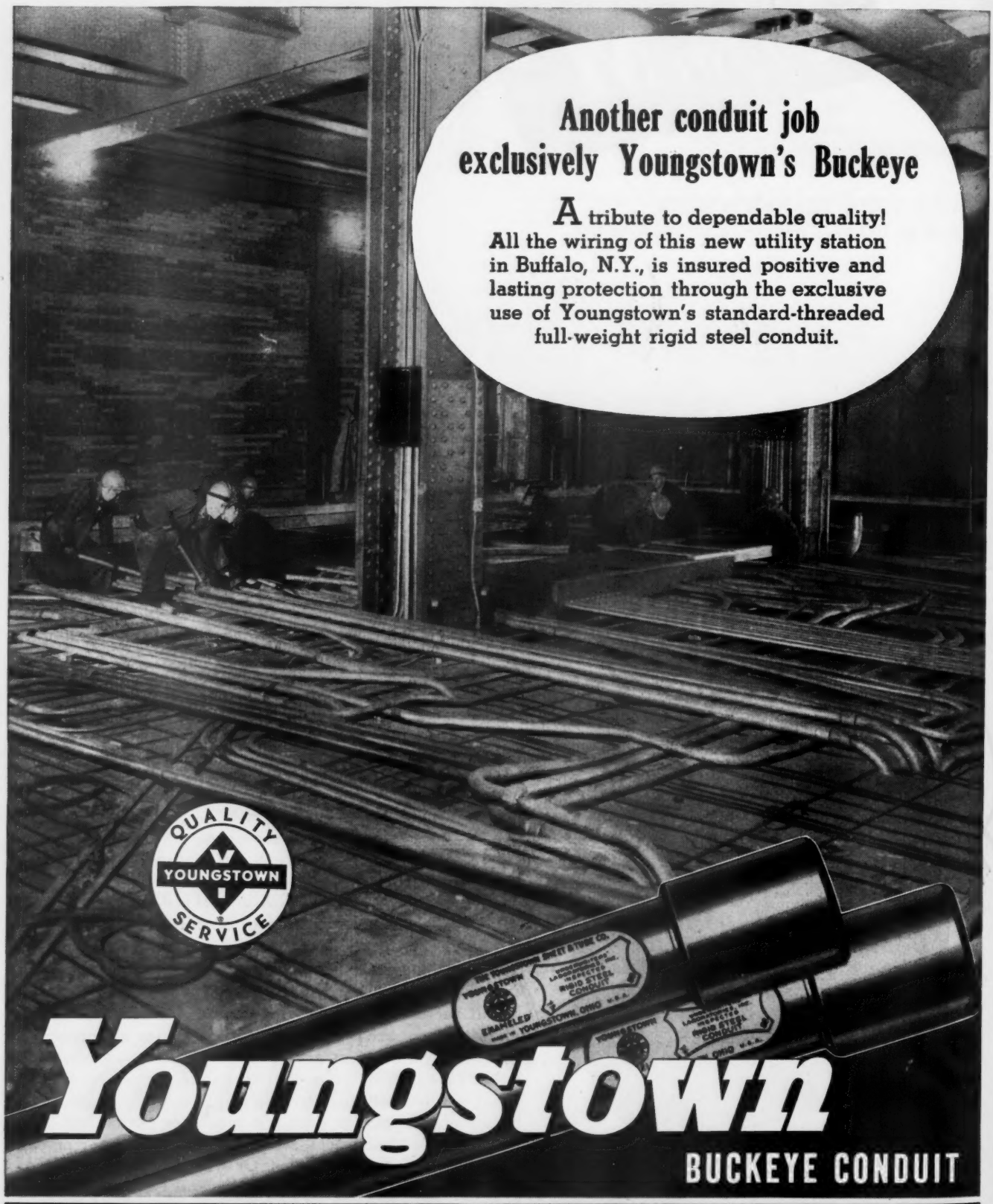
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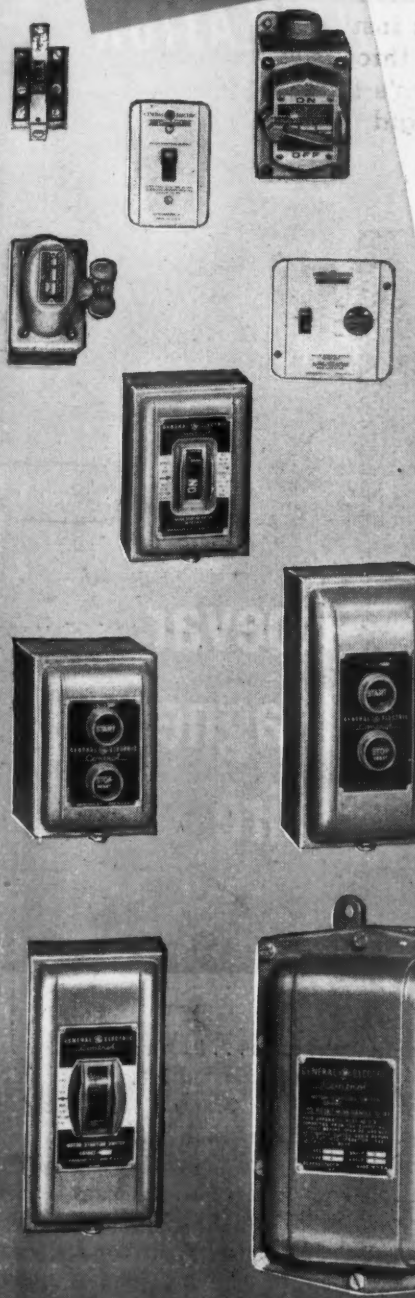

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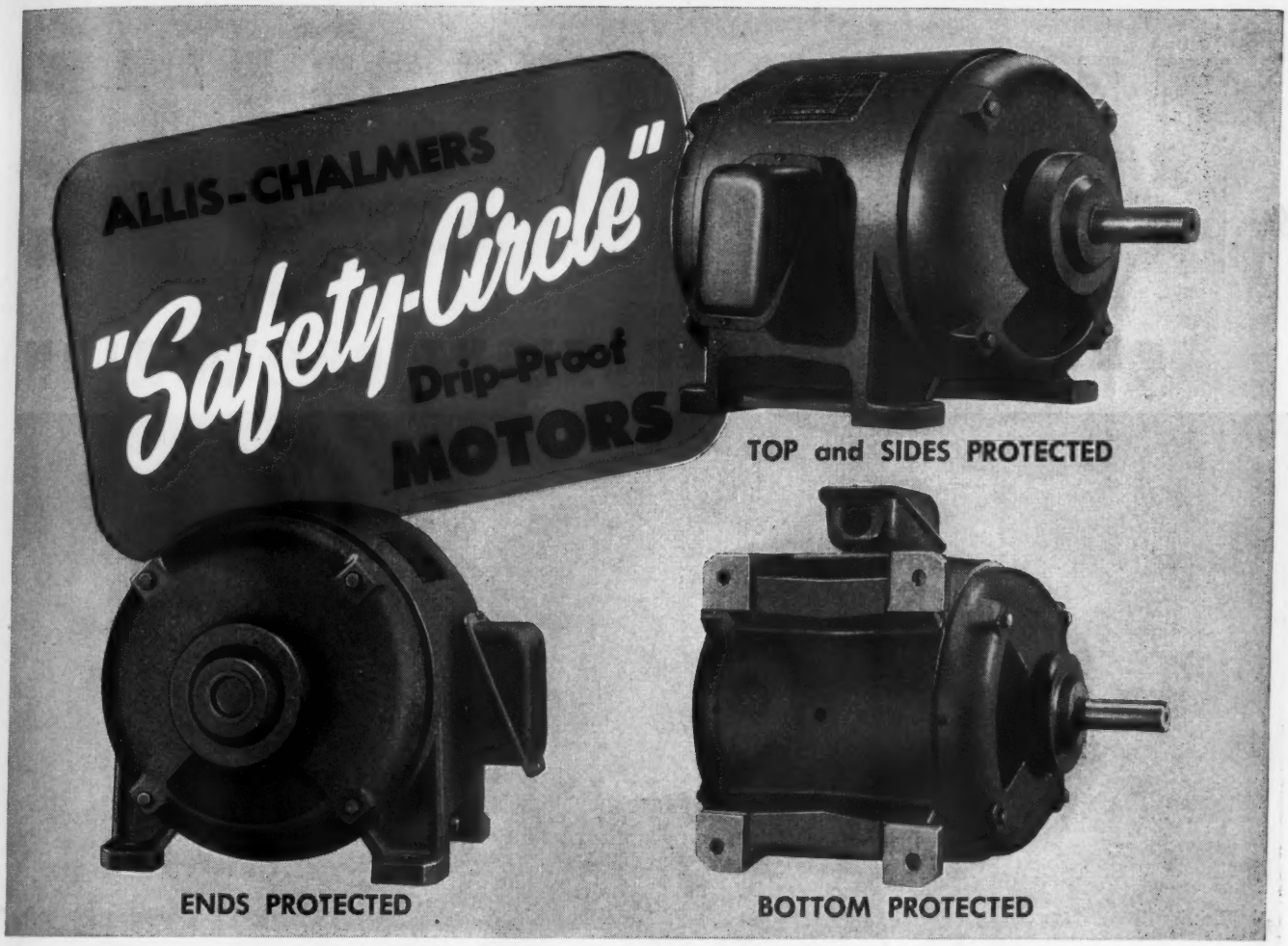

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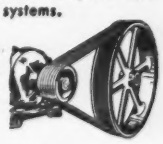

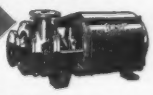

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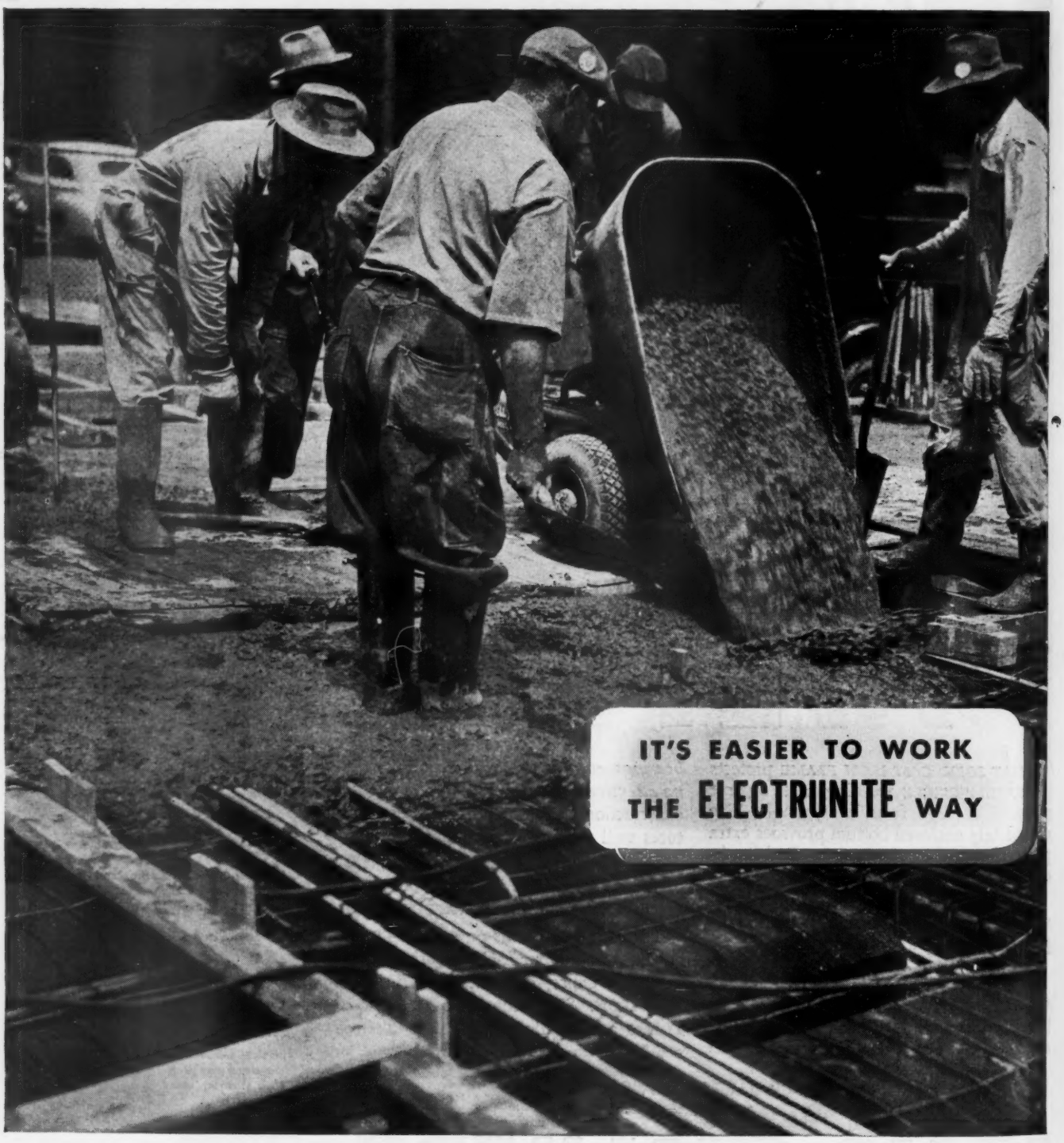

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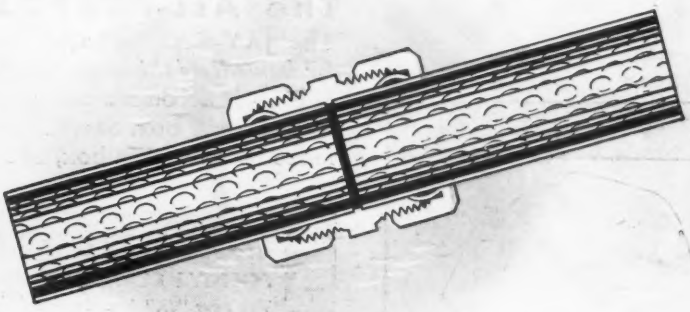
IN WALLS UNBROKEN BY THREADS . . .



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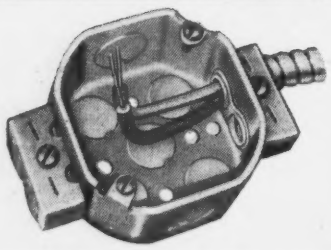
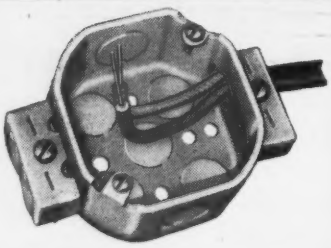
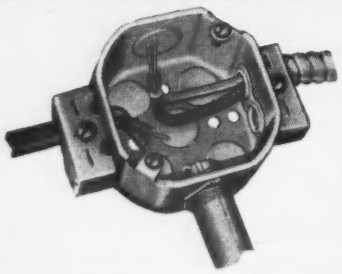


OR WITH FLEX



OR WITH PIPE AND BX OR FLEX

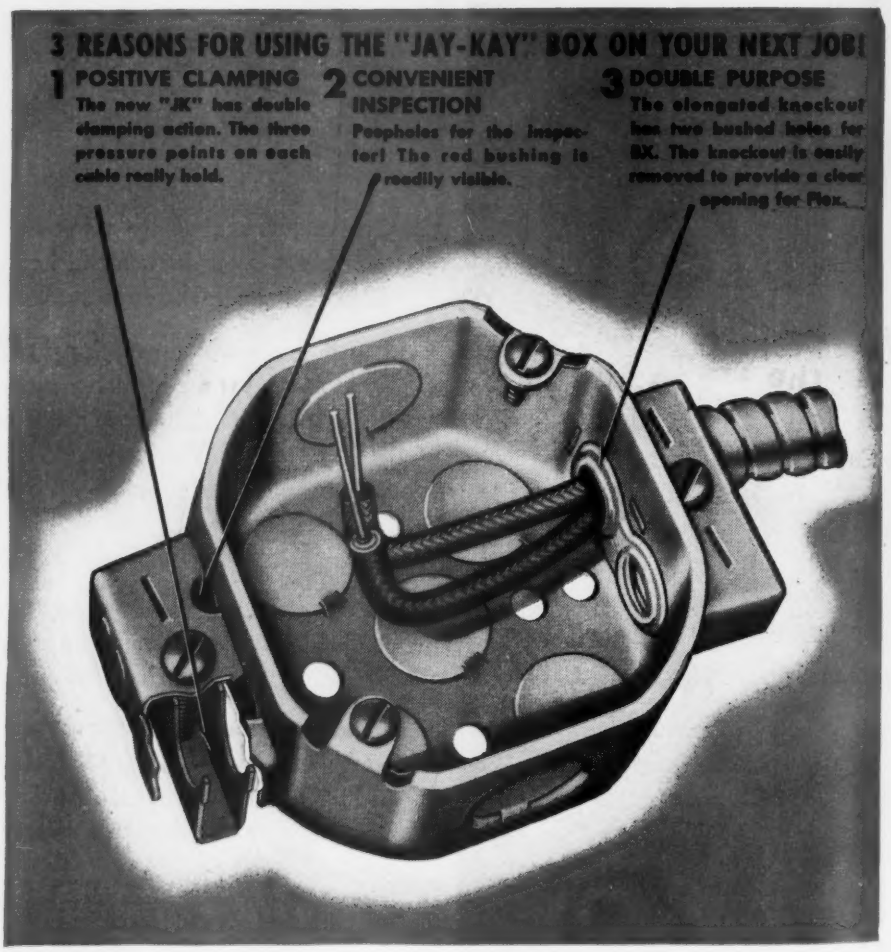


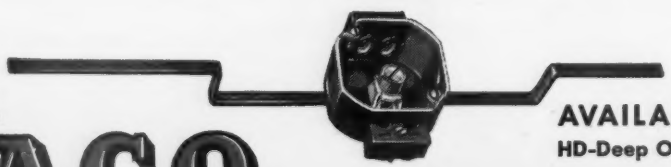
3 REASONS FOR USING THE "JAY-KAY" BOX ON YOUR NEXT JOB!

1 POSITIVE CLAMPING The new "JK" has double clamping action. The three pressure points on each cable really hold.

2 CONVENIENT INSPECTION Peepholes for the inspector! The red bushing is readily visible.

3 DOUBLE PURPOSE The elongated knockout has two bushed holes for BX. The knockout is easily removed to provide a clear opening for Flex.





"JAY-KAY" BOXES ARE AVAILABLE ON BAR HANGERS, TOO!

HD-Deep Offset HS-Shallow Offset HSS-¾" Offset

*Reg. Trade Mark

RACO

ALL STEEL PRODUCTS

A Box for Every Need

ALL-STEEL EQUIPMENT INC.

600 KENSINGTON AVENUE • AURORA, ILLINOIS

New!

GLAZON™ TRADE MARK

"TRIEX"

PREPARES FOR STRIPPING

5 times Faster!

HERE'S WHY:

The Present Way

You have to split the outer covering and trim it off. Then rip off the filler if it doesn't come away clean. Spread the wires apart and u-n-w-i-n-d the kraft paper wrap from one, *then* u-n-w-i-n-d the paper wrap from the other.

The New TRIEX Way

Just split the "Glazon" covering—tear it off—zip! The wires are ready to strip! That's all!

PLUS! EXTRA THICK INSULATION!

Not just the 2/64th rubber thickness found in ordinary cable . . . nor even a generous 3/64ths . . . but 4/64ths inch thickness of Type R rubber surrounds each conductor—even on sizes 14 and 12! You can see for yourself what this means in terms of extra protection . . . extra safety—and at no extra cost!

PLUS! EXCLUSIVE "GLAZON" COVERING!

TRIEX is the only non-metallic sheathed cable with this tougher, stronger, longer-lasting outer covering. Based on an inorganic substance derived from glass—which cannot burn, rot, or corrode; which is not affected by water, moisture, acid fumes, fungus or sunlight—"Glazon" achieves new highs in resistance to fire, moisture, oil, rodents and other elements that attack ordinary coverings. Clean and easy to handle—new finish uses no mica—it's slick!

Now you can prepare TRIEX Non-Metallic Sheathed Cable for stripping *five times as fast* — thanks to this new Triangle development!

Compare the *ordinary* way of preparing *present* types of non-metallic sheathed cable with the *faster* way, the *easier* way, the *simpler* way, of preparing Triangle's *new* TRIEX! See for yourself how *you* can save time and money at every switch box, outlet box, junction box . . . wherever connections are made!

Available in sizes 14/2, 14/3, 12/2 and 12/3 . . . solid or stranded . . . with or without ground wire. For 600 volt service.

If It's "Glazon" TRIEX It's Made by Triangle . . .
If It's Made by Triangle IT MUST BE RIGHT!

For samples and full information, contact your nearest Triangle distributor or representative, or write

ARTERIES FOR ELECTRICAL SYSTEMS — INCORPORATED

IT MUST BE RIGHT!

TRIANGLE CONDUIT & CABLE CO., INC.

1908 JERSEY AVENUE • NEW BRUNSWICK, N. J.

PLANTS: NEW BRUNSWICK, N. J. • MOUNDSVILLE, WEST VA.

BUILDING WIRE • BARE WIRE • ARMORED CABLE • "GLAZON" TRIEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE, SERVICE DROP, VARNISHED CAMBRIC BRAIDED OR LEADED, TRIOPRENE TRENCH, POWER AND PARKWAY CABLES RIGID CONDUIT • ELECTRIC METALLIC THIN WALL CONDUIT • FLEXIBLE STEEL CONDUIT

Get CORRECT CONDUIT CONNECTIONS

The easy economical way

Cross Section Showing Indentations

• NEATER • STRONGER • FASTER • APPROVED

All B-M Fittings Carry the Underwriter's Seal of Approval and Canadian Standards Ass'n Approval No. 9296

Select the best, insist on Briegel All Steel Fittings, the original approved Indenter type connectors and couplings for thin wall conduit tubing. You will not only find that Briegel Indenter Fittings are easier and faster to use, but also make neater, stronger connections, the correct connections. Two Easy Squeezes and they're set. Start using Briegel Fittings today. Have more satisfied customers—more profits from each job.

DISTRIBUTED BY

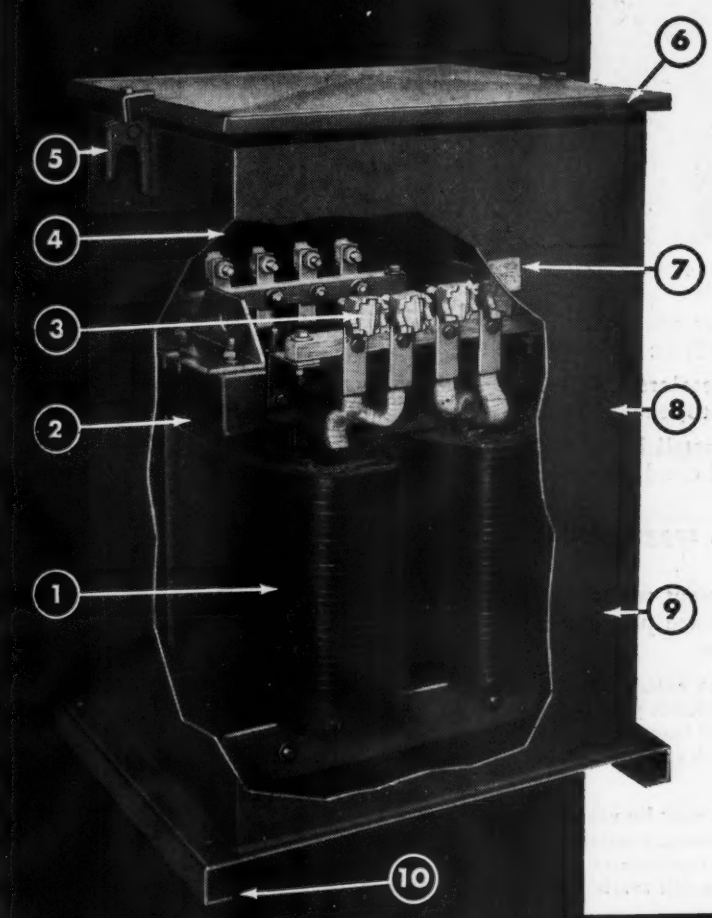
The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Enameled Metals, Pittsburgh, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

BRIEGEL METHOD TOOL CO.

GALVA, • ILLINOIS

EASY INSTALLATION LOW UPKEEP LONG LIFE...

WITH ALLIS-CHALMERS *Dry-Type* TRANSFORMERS



1 CLASS B INSULATED — means added protection against fire hazard, lighter weight, longer life than Class A insulated units.

2 IMPREGNATION with heat resisting varnish makes windings and insulation a solid unit . . . mechanically and electrically strong.

3 TIME-SAVING solderless clamp type connectors are used on single phase (Type BD) units 15 kva and larger and on three phase (Type BDT) units 37½ kva and larger.

4 BIG roomy wiring compartment with conduit knockouts cuts hook-up time.

5 LIFTING HOOKS project well out for easy hoisting.

6 COVER is quickly and easily removed.

7 CONVENIENT CONNECTION DIAGRAM and rating on name plate simplifies line hookup . . . gives data for reordering.

8 STRONG, SAFE CONSTRUCTION . . . Core and coils enclosed in heavy gauge sheet steel casing with proper allowance for good ventilation.

9 SURFACE FINISH is resistant to corrosion by acids . . . vapors . . . moisture. Surface is Sprabonderized, followed by 3 coats of separately, baked-on paint.

10 STANDARD PROVISIONS made for anchoring unit to wall or floor.

YOU CAN PUT POWER at load centers . . . where you need it . . . *fast* with Allis-Chalmers dry type transformers. Advantages: Only short length of heavy secondary line required for low voltages — line losses minimized — constant voltage — stepped-up motor and lamp performance!

Allis-Chalmers Class B insulated dry type transformers are available in 14 sizes up to 500 kva . . . single and three phase. For information regarding the size to meet your requirements, contact your nearby Allis-Chalmers dealer or sales office. Or write direct for bulletin B-6382. A-2741

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Title 608 Project: Courtesy James G. Ludwig, R. A., Architect, West Chester and Upper Darby, Pa.

Architects, builders and electrical contractors are switching to GENERAL SWITCH equipment because it is:

Available everywhere through leading wholesalers—No lost labor time waiting for GENERAL equipment to reach the job.

Economical to install—Takes less time to install because of compact open construction, integral internal conductors and spacious wiring room.

Thoroughly dependable—Quality materials, rugged design, and rigid factory inspection.

HERE are three units of GENERAL equipment which have been "application engineered" for and are particularly well suited to low-cost housing construction:

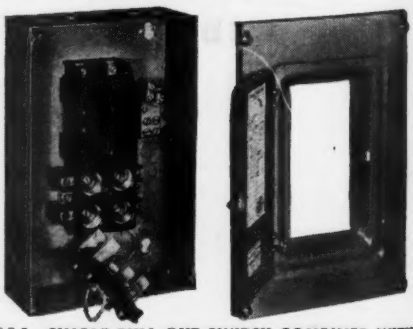
GENERAL SWITCH 33NP4—Ideal selection where an externally operated switch is required in combination with a residence panel at the point of service entrance. Has the advantage of dead front branch circuit fuses yet the entire unit is readily accessible with spacious wiring room. Also available in raintight construction.

GENERAL SWITCH 3614—Where a pull-out switch may be used, this equipment offers economy, versatility and compactness. Available for flush or surface mounting. Has sub-feed pressure connectors which may be used as main lugs, leaving the pull-out switch available for range, water heater or other circuit.

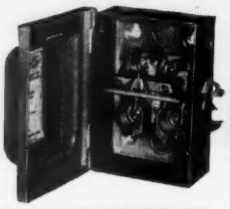
GENERAL SWITCH 33NP and 104—When it is desirable to have the branch circuit fuse panel conveniently located remotely from the switch, this service entrance switch and plug fuse panel has wide acceptance. Residence panel available for flush or surface mounting.

For availability, economical installation and trouble-free performance *the switch is to* GENERAL. Available everywhere exclusively through Wholesalers.

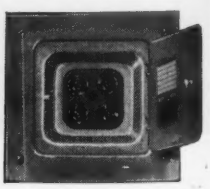
33NP4—EXTERNALLY OPERATED SAFETY SWITCH COMBINED WITH BRANCH-CIRCUIT PANEL—30 Amp, 3 wire, 2 plug fuse quick-break knife blade switch with four plug fuse branch circuits. Bus-bars between switch and fuse block save wiring time.



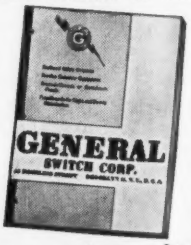
3614—SINGLE PULL OUT SWITCH COMBINED WITH BRANCH-CIRCUIT PANEL—Available in 30 or 60 Amp with up to 6 branch circuits or in 60 Amp with as many as 12 branch circuits. Surface or flush.



33NP—EXTERNALLY OPERATED SAFETY SWITCH—3 wire, 2 plug fuse quick-break knife blade switch for use as service entrance equipment.



104—BRANCH-CIRCUIT or RESIDENCE PANEL—Available up to 32 plug fuse circuits. Flush spring catch. Surface or flush.



Ask your wholesaler or write today for the GENERAL SWITCH 68-page catalog

GENERAL SWITCH CORP.

49 ROEBLING STREET, BROOKLYN 11, N. Y. • *Sales Offices in every major city*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Fluorescent
SLIMLINE
Industrial Luminaire

8′ LENGTH—
HIGH LUMEN OUTPUT

WIDER ROW SPACING

FEWER FIXTURES TO BUY—
TO MAINTAIN

INSTANT STARTING—
NO STARTERS REQUIRED

Call your local Westinghouse Distributor. He will gladly co-operate with you, your architect, electrical contractor and utility in planning the use of Fluorescent Slimline Industrial Luminaires.

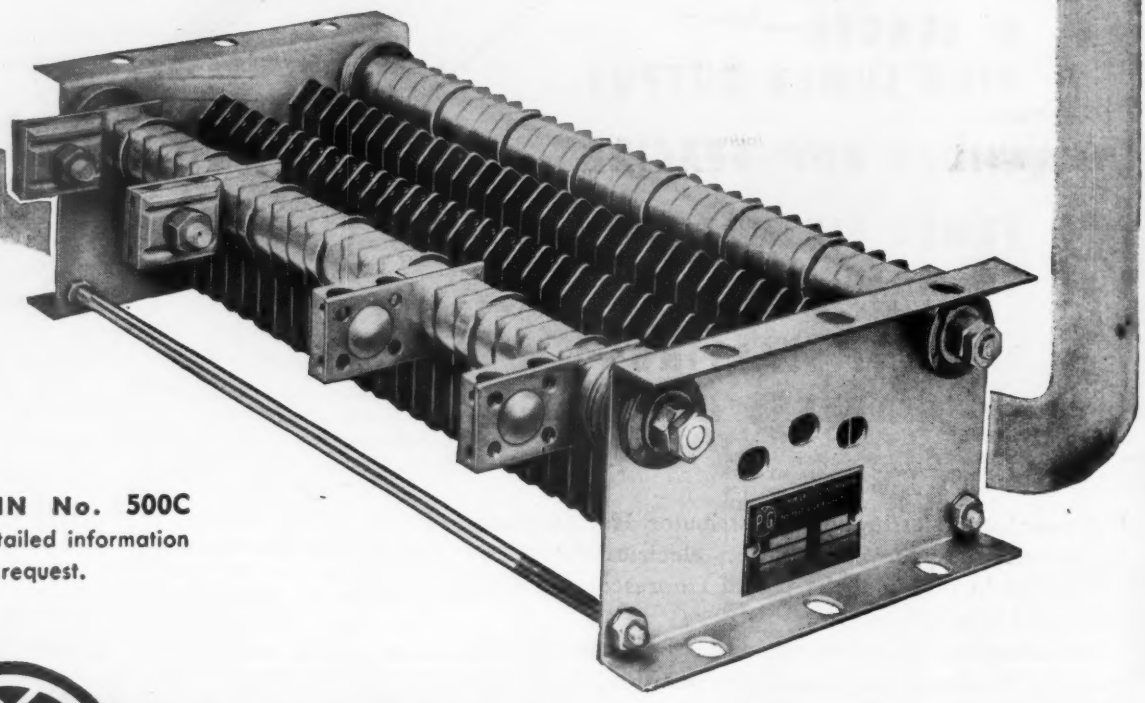
For complete information, write for free booklet B-3737, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-04238

Westinghouse

PLANNED LIGHTING PAYS

Dependable RESISTOR *Performance*

P-G Steel Grid Resistors are basically dependable because of steel and mica—non-breakable raw materials. With P-G unique grid design, plus sound resistance values and conservative capacities, resistor troubles are minimized. Specify these dependable resistors for your next application.



BULLETIN No. 500C
Gives detailed information
Copy on request.

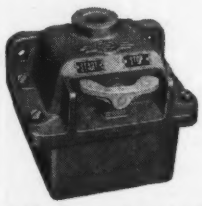
P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY
• ESTABLISHED 1892 •
221 WEST THIRD STREET, CINCINNATI 2, OHIO

For Every Electrical Actuating Need—there's a CLARK PUSH BUTTON!

Clark Type "D" Heavy Duty Push Buttons are sturdily built to provide outstanding service in heavy duty operations. These Push Button elements and stations are available in a great variety of arrangements, contact requirements, and enclosures, and also include Pilot Light and Selector Switches which are interchangeable with the Push Button elements.



Type D—Heavy Duty Push Buttons. Above—for Class I, Group D, Hazardous locations; Below—Dust-tight and water-tight enclosure.

The following table shows mounting arrangements available

HEAVY DUTY STATIONS AND ELEMENTS			
TYPE	MOUNTING ARRANGEMENT	APPARATUS	ENCLOSURE
D	Surface	Assembled Stations	Standard
D	Surface	Elements Only	Open
D	Flush Plate	Assembled Stations	Pull-box available
D	Steel Panel	Elements Only	Open
D	Slate Panel	Elements Only	Open
D	Surface	Assembled Stations	Dust-tight and Water-tight
D	Surface	Assembled Stations	Class I, Group D Hazardous Locations
D	Pendant	Assembled Stations	Standard
D	Surface or Semi-flush	Mill Button	Cast
DO (Oil Tight)	Steel Panel	Elements Only	Open

Type D, Form RN "Roughneck" Push-button for heavy duty service. Below, Form RNG with guard ring.

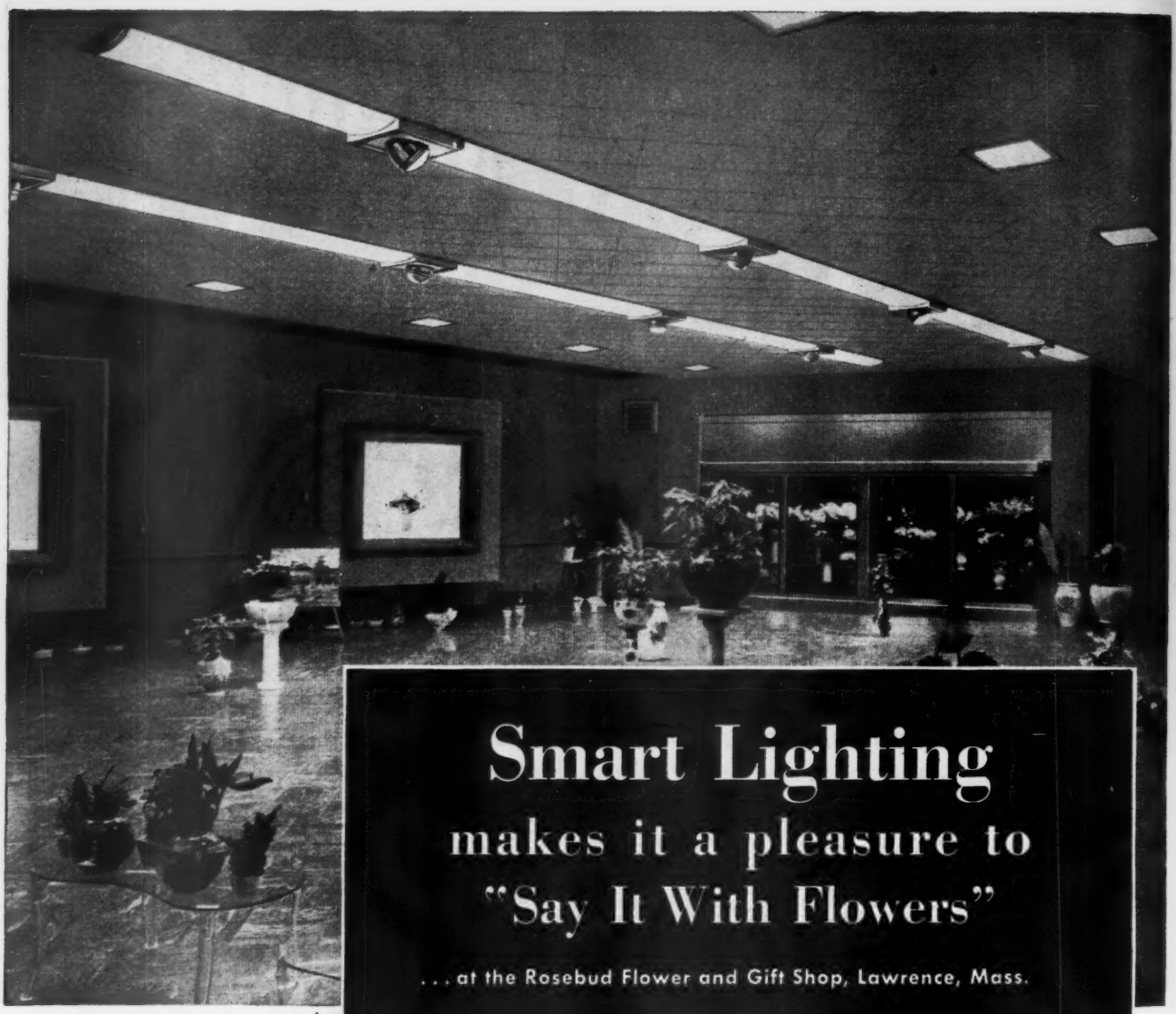
Modifications for surface mounted assembled stations include Mushroom Heads, Hold down rings with lock clip. Snap latch for jogging arrangements, maintained contact elements, and additional contacts on push button elements.

Also available are several types of Standard Duty Buttons for use on ordinary starter applications no larger than NEMA Size 4, 150 ampere size.

Available through your CLARK distributor.

THE CLARK CONTROLLER CO.

EVERYTHING UNDER CONTROL • 1146 EAST 152nd STREET, CLEVELAND 10, OHIO



Smart Lighting

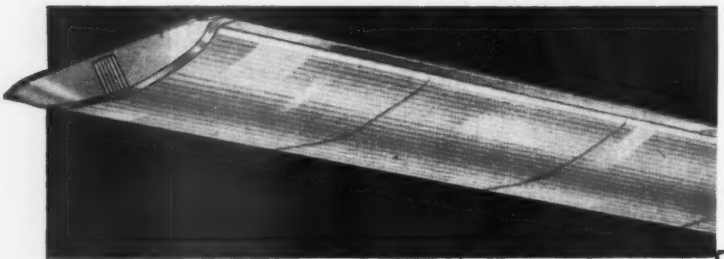
makes it a pleasure to "Say It With Flowers"

... at the Rosebud Flower and Gift Shop, Lawrence, Mass.

Architects: Ashton, Huntress & Pratt
Lighting Engineer: Henry R. Loeschner, Lawrence Gas & Electric Co.
Lighting Equipment: Litecontrol No. 9134, 3-lamp lens fixture; No. 12F-V30 lens boxes; No. P38 UF adjustable spots; 20 and 40 watt fluorescent strips inside shadow boxes.
Footcandles: 35 in service (average).

Delicate flower shapes and colors vibrate with fresh, natural beauty in the smooth, well-diffused light of this ultra-modern flower shop. Evidence again of how Litecontrol fixtures can add lighting punch that pushes sales curves up.

Whether your clients are selling flowers, flour or flannels, you'll find Litecontrol engineers . . . and Litecontrol fixtures . . . the answer whenever you want unusually effective lighting installations. We'll be glad to help with new, and different, ideas or complete lighting layouts.



...with LITECONTROL NO. 9134 FIXTURE

The basic unit of this distinctive lighting installation is a flush, troffer-type fixture, using Holophane Controlescent® curved lenses which give unusually effective light distribution. Sturdy and strong, it's easy to install and a guarantee of long years of trouble-free service.

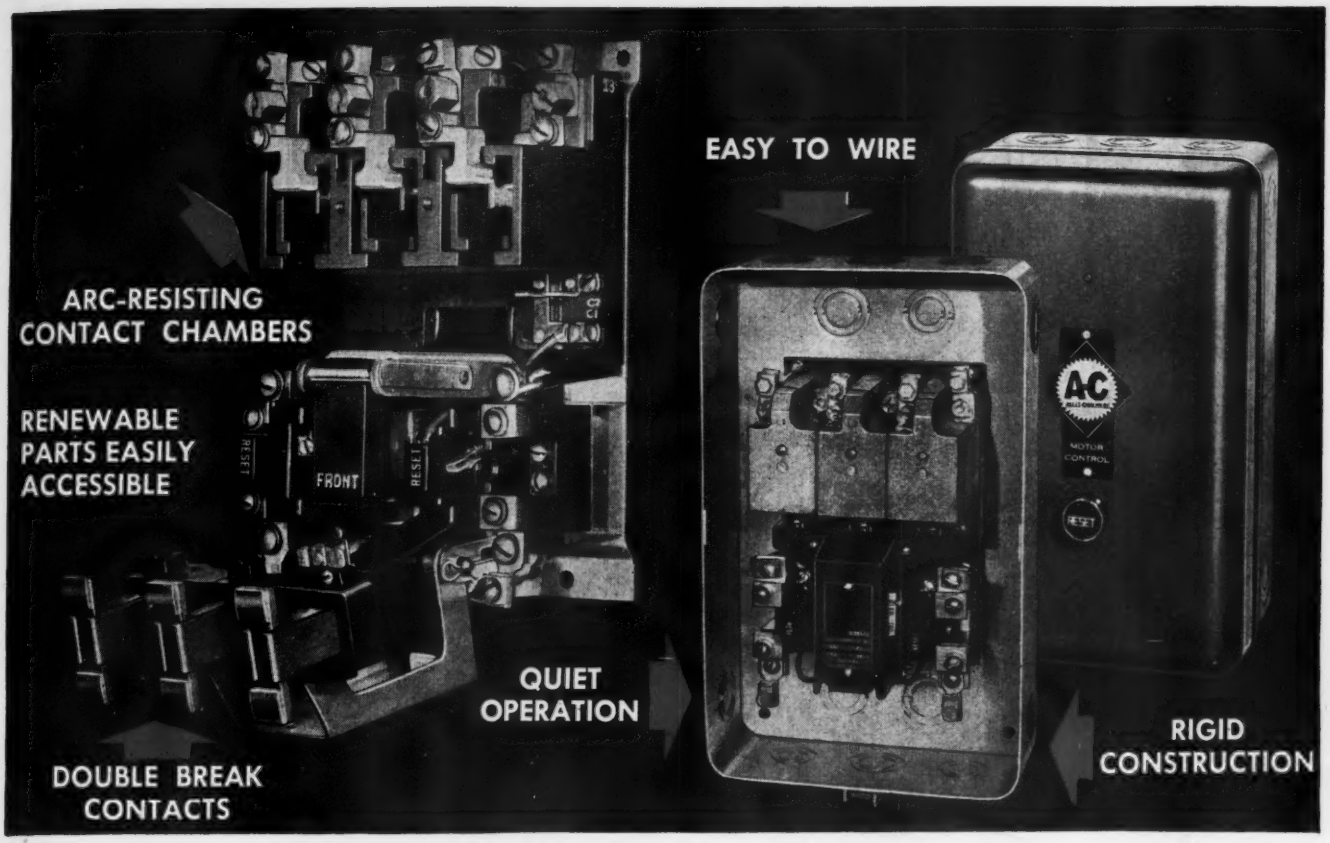
Cat. No.	No. of Lamps	HOUSING Length	Width	Height	TRIM Length	Width	Weight
9124	2-40W	48"	13¼"	5⅝"	51"	15¼"	46 lbs.
9134	3-40W	48"	13¼"	5⅝"	51"	15¼"	51 lbs.

End Cap — No. 9100-3. Suspension Strap — No. 9100-6

LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

LITECONTROL *Fixtures*
KEEP UPKEEP DOWN

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS



Get *All* these Features

IN ALLIS-CHALMERS SIZE 0-3 LINE STARTERS

FOR UNFAILING START-STOP SERVICE . . . for easy installation and simple maintenance . . . you can specify an Allis-Chalmers motor starter *with confidence.* For *quality* construction goes into every A-C motor starter regardless of size! Quality features in NEMA 0-3 line starters include:

1. EASY TO WIRE — Terminals are clearly marked, accessible in roomy enclosures.

2. ACCESSIBLE — Contact assemblies can be removed or swung forward by removing only two screws. Movable contacts are held in clips by springs; stationary contacts are held by a single screw. Modified *E* magnet coils are easily removable. All renewable parts can be readily inspected or replaced.

3. DOUBLE BREAK CONTACTS add to interrupting capacity. *Silver* to *silver* surfaces give long life, low contact resistance — assure against corrosion and require *no dressing.*

4. ENCLOSED ARC CHAMBERS confine arcing. Sizes 2 and 3 contactors have magnetic yokes which act as blowouts.

5. QUIET OPERATION — Shading coils eliminate alternating current hum.

6. RIGID CONSTRUCTION — Steel base supports magnet and contact assembly for proper alignment of floating armature.

Get delivery on these starters off-the-shelf through your nearby Allis-Chalmers Authorized Dealer.

FOR LARGER MOTORS . . . sizes 4, 5, 6, and 7 Across-the-Line, and special purpose starters are available.

For reduced voltage starting, you can select from Auto-Transformer, Resistor or Reactor types.

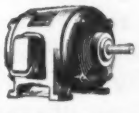
For *any* motor . . . *Squirrel Cage, Wound Rotor* or *Synchronous,* Allis-Chalmers offers you a wide selection of controls.

A-2753

Texrope is an Allis-Chalmers trademark.

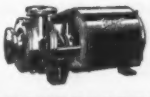
Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.



MOTORS — ½ to 25,000 hp and up. All types.

TEXROPE — Belts in all sizes and sections, standard and Vari-Pitch sheaves, speed changers.



PUMPS — Integral motor and coupled types. Sizes and ratings to 2500 GPM.

ALLIS-CHALMERS, 930A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

"You can control any motor with an Allis-Chalmers motor starter."

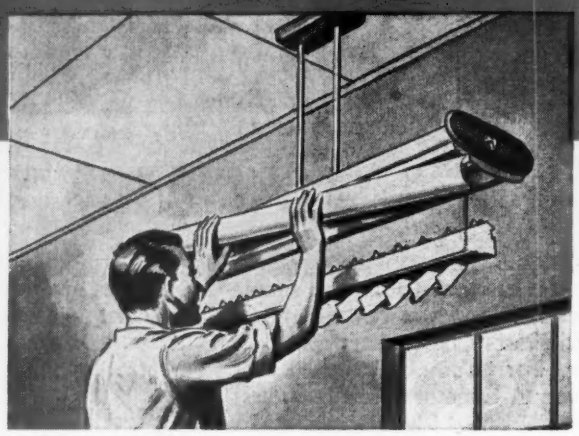
JUST OUT!

Single sweep of light. Engineered specifically to meet the most exacting requirements of schools, offices and stores, these CL-242 units have been designed to join with no apparent separation—giving long, continuous lines of high quality light!

Modern design gives this new fixture a beautiful, streamlined appearance, making it ideal for most any architectural scheme. The louvers and luminous plastic side panels effectively shield the lamps and add to the trim appearance of the fixture.

Efficient—85.5% when pendant mounted! Unparalleled in any fixture of its type! Purchaser's lighting dollar will go further than ever before! About 55% of the light is indirect and 45% direct, reducing brightness contrast between ceiling and fixture to a minimum. Exclusive Sylvania Miracoat finished reflector has a minimum reflection factor of 86%!

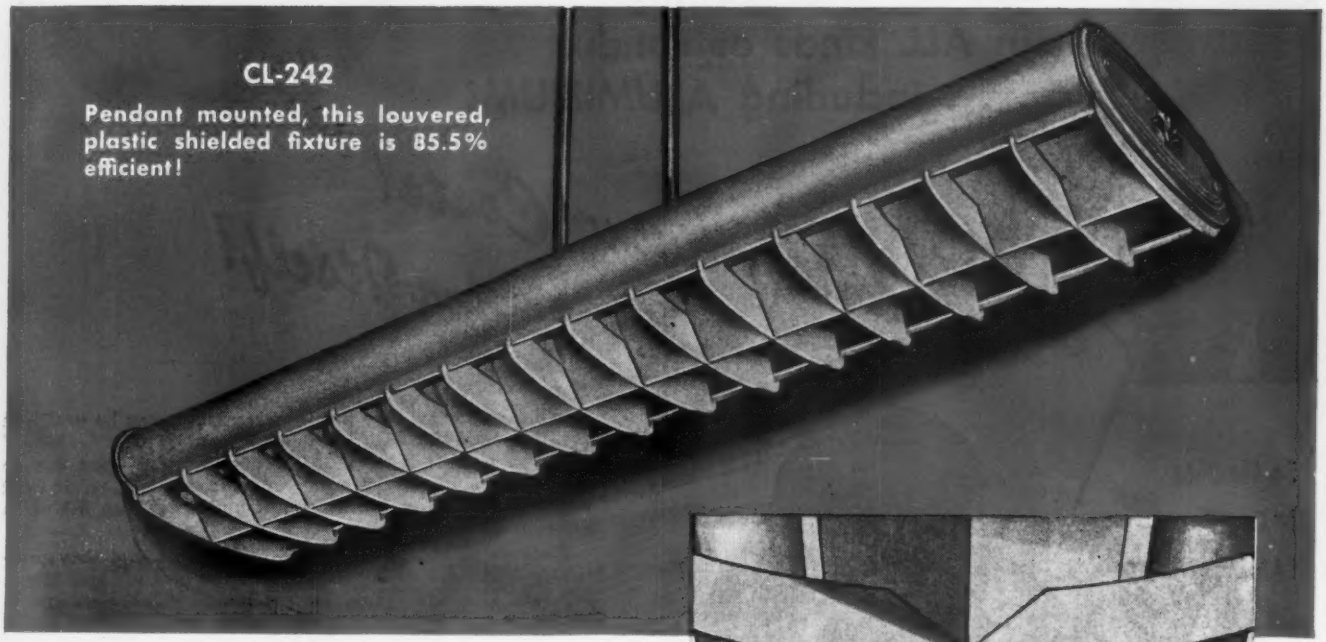
No vibration in this unit! The 20 gauge steel fixture features a one-piece reflector and louver with the baffles *crimped* by an exclusive Sylvania method—there are no loose parts to rattle.



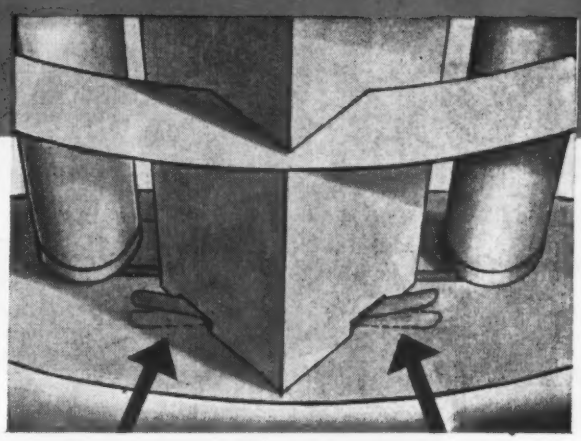
Easy to service—re-lamping has been made extremely easy by simply lifting out either of the plastic side baffles.

Easy to mount—can be surface or pendant mounted, singly or in continuous rows. Single or double stems used for pendant mounting. Easily and quickly joined by fastening end plates of joining units together with one pair of small screws. No joining bands or other accessories required. Single stems may be used on continuous row installations. For surface mounting, no mounting plates are needed since the chassis may be secured directly to the ceiling! Chassis has seven knockouts on top—one being a large center tearout for surface installation and easy access to outlet box circuit wires.

SYLVANIA'S TRIM, LOW-COST, SCHOOL AND OFFICE UNIT FEATURES "ENGINEERED" ECONOMIES



Exclusive reflector spring latches located at both ends of the unit, release the entire reflector and louver assembly for easy lamp replacement and cleaning. Once released, this assembly is held directly below the fixture by captive chains which are quickly detached if necessary. These engineered maintenance features save time and money on the job.



Arrow indicates exclusive Sylvania reflector spring latch which simply and efficiently releases reflector for installation and maintenance! SEND COUPON TODAY if you haven't already received full information!

SYLVANIA ELECTRIC

FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES, SIGN TUBING; LIGHT BULBS; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Mail coupon for further information!

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Advertising Dept. L-6008
500 Fifth Ave., New York 18, N. Y.

Gentlemen:

Kindly forward full details on your new CL-242 Fluorescent Fixture.

Name .....

Company .....

Address .....

City ..... State .....

IDEAL

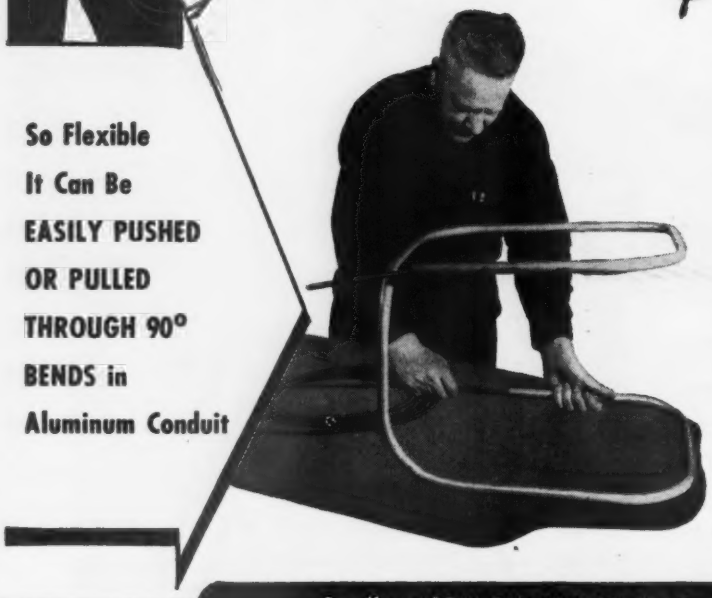
Coil-Flex

(Patent Pending)

NEW FISH-TAPE

speeds wire pulling in ALL kinds of conduit . . . including ALUMINUM!

Cuts Wiring Costs! Pays for Itself!



So Flexible It Can Be EASILY PUSHED OR PULLED THROUGH 90° BENDS in Aluminum Conduit

You'll never know how much easier fishing can be until you use the new IDEAL "Coil-Flex" Fish Tape. "Coil-Flex" slides so easily—takes so little push or pull—you can do twice the fishing in the same time without fatigue. It can't cut or damage *aluminum* conduit and speeds up fishing in *any* conduit.

Because all surfaces of "Coil-Flex" are round they practically eliminate slide resistance in the conduit and give a *big* safe grip that's easy on the hands. "Coil-Flex" never kinks or snarls—never springs loose into "hot" wires or machinery. It rolls up into an easy-to-handle 10-inch circle.

"Coil-Flex" consists of a 25-foot length of .332-inch diameter steel spring wound around a rust-proof aircraft-control type steel cable. Each length has a male fitting on one end and a female fitting on the other. Any number of lengths can be quickly joined together to make longer tape. Every tape is factory tested for 400 pounds pull.

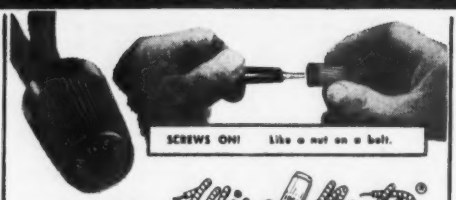
Ask your IDEAL Distributor to show you "Coil-Flex" today.

IDEAL Fish Tape, Reels and Pullers and Flat-Type Fish tape also available.

See Your IDEAL DISTRIBUTOR for Tools and Products for Every Wiring Job

IDEAL VOLTAGE TESTER

A real Solenoid Tester—Not an ordinary "glo" type! Actually indicates nominal line voltage from 110 to 600 volts—AC or DC. Solenoid indicator and neon test lamp GIVE DOUBLE PROTECTION.



IDEAL Wire-Nuts®

Patented, No. 1,933,555

The Solderless, Tapeless Wire Connectors

SCREWS ON—like a nut on a bolt. The *proved* way to faster, stronger, safer wire joints. Precision-built and tested IDEAL Spring Insert that can't pull or shake loose. Cut costs *with complete safety* on *all* wire joints from 3 No. 10 to 2 No. 18 wires, solid and/or stranded. Be sure you get IDEAL "Wire-Nuts."

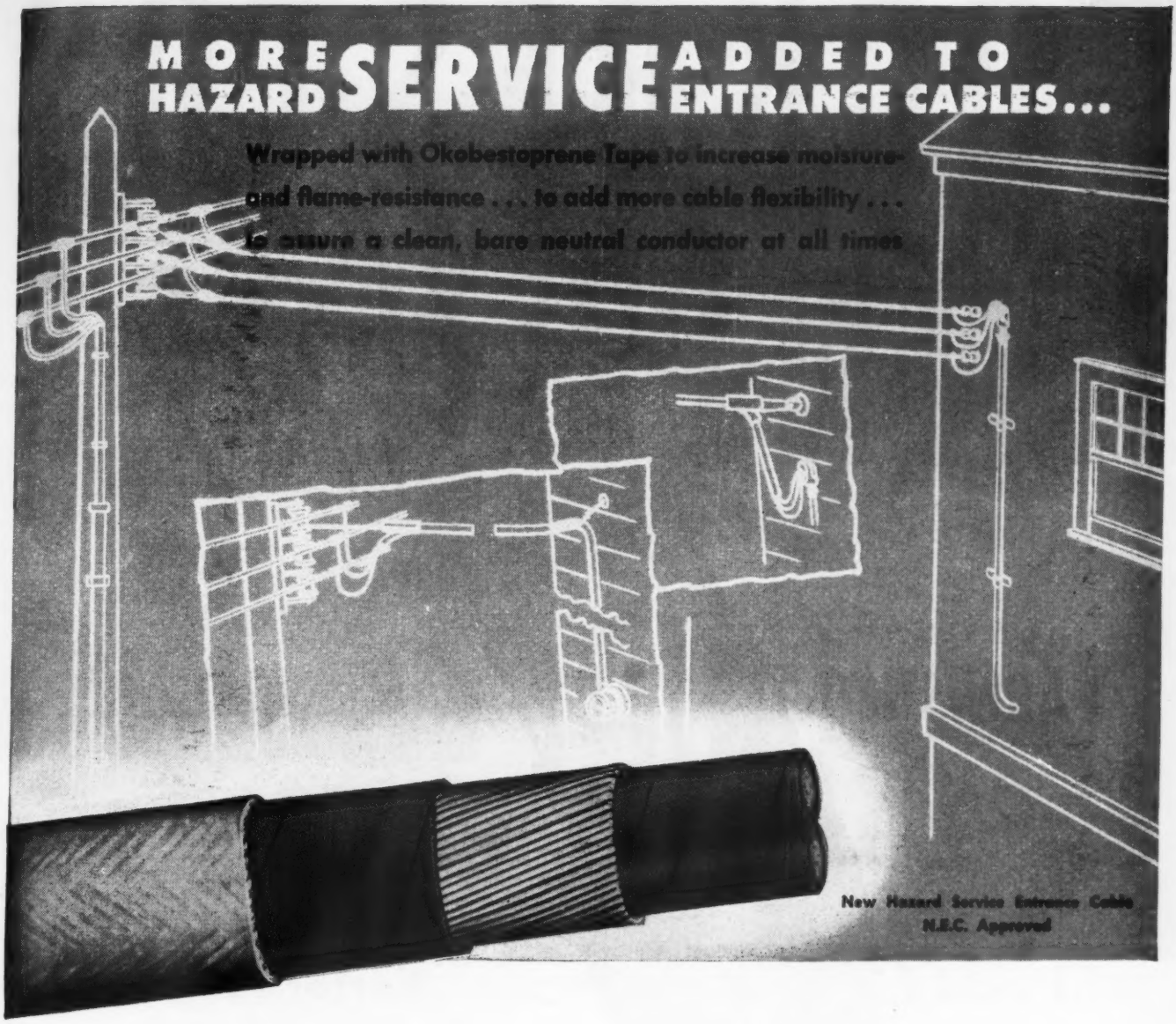
New IDEAL Stripmaster WIRE STRIPPER

New, revolutionary — different from any other stripper you've ever seen! *Single* light squeeze strips wire up to full 7/8 inch. "Automatic" feature positively prevents crushing of wire. Just insert wire, squeeze and release. Five Models — For all wire gauges from 8 to 22.

Distributed Through America's Leading Wholesalers

IDEAL INDUSTRIES, Inc. Sycamore, Illinois

MORE HAZARD SERVICE ADDED TO ENTRANCE CABLES...


Wrapped with Okobestoprene Tape to increase moisture- and flame-resistance . . . to add more cable flexibility . . . to assure a clean, bare neutral conductor at all times
New Hazard Service Entrance Cable N.E.C. Approved

WITH types UBN and ABN Hazard Service Entrance Cables, black and red Okobestoprene Tapes are now wrapped over the individual insulated conductors in the place of the old style color coded braids. And another layer of Okobestoprene Tape is wrapped over the bare neutral conductor as a moisture seal and for additional outside protection.

Okobestoprene Tape, a recent development of The Okonite Company, combines asbestos fibres with neoprene. It's unusually resistant to moisture, mildew, acids, alkali, weather and is flame-resistant.

In service entrance cable use, this means there's no moisture absorbing fabric to wick in water. In the manufacturing process, the heat of the saturating operation of the *outside* braid covering, actually seals these tape layers into solid moisture-resistant *sheaths*. This new construction also provides extra flexibility to the cable because the Okobestoprene-sheathed conductors can twist and slide more easily within this flexible armor.

A third important advantage of this new Hazard construction is that there is no inside saturant to seep out onto the bare neutral conductor. And as the bare conductor itself is wrapped in a layer of Okobestoprene Tape, it is protected from the outside saturant. Thus you always have a clean concentric conductor to work with.

For further details see your Hazard supplier or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

6241

insulated wires and cables for every electrical use

ROCKBESTOS ANNOUNCES

VARNISHED CAMBRIC CABLE

an addition to our line to give you better service

Rockbestos VC cables are manufactured by men with the "know-how" gained from 23 years experience with varnished cambric tapes for high temperature operation on AVC cables.

Insure trouble-free operation and long life of your VC cables. Specify VARNISHED CAMBRIC CABLES by Rockbestos.

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONNECTICUT

NEW YORK CLEVELAND DETROIT CHICAGO PITTSBURGH
ST. LOUIS LOS ANGELES OAKLAND, CALIF.

Planned and made to fit *your* needs best, Rockbestos Varnished Cambric Cable is available in every size you require. Write today for specifications and prices.

WIRES and CABLES by

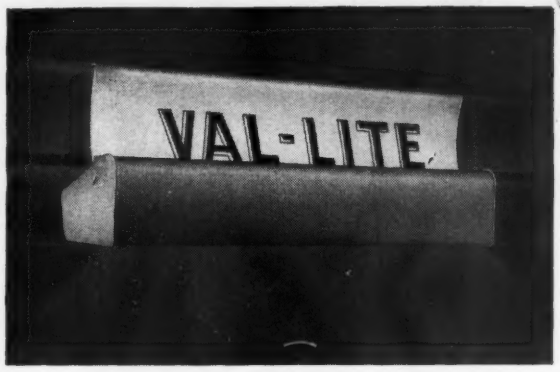
ROCKBESTOS

. . . . . dare to be better

Engineered Illumination!

Distinctive Display Lighting!

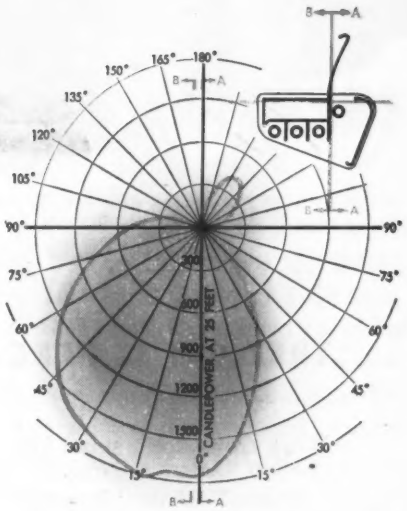
Effective Advertising!



...all three combined in the NEW KENT-MOORE VAL-LITE!

Up and down Main Street . . . from one end to the other . . . you'll find a rich and ready market waiting for the new Kent-Moore VAL-LITE. For VAL-LITE is a special fluorescent fixture designed to meet *three* specific lighting requirements in the vast commercial lighting field. (1) It provides well-diffused indirect illumination in either single or multiple fixture application. (2) It creates "buy-appealing" merchandise displays . . . distinctively lighted to catch and hold customer attention day or night. (3) And, with attractive, easy-to-change individual letters, VAL-LITE permits effective "point-of-purchase" advertising of products or services.

Complete specification and installation data is contained in a new VAL-LITE Merchandising Manual . . . write for your copy today!



Candlepower Distribution Chart for VAL-LITE Model J-1817 equipped with four 40-watt fluorescent lamps.

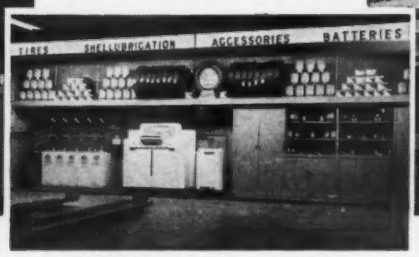
Kent-Moore

ORGANIZATION, INC.

GENERAL MOTORS BUILDING • DETROIT 2, MICHIGAN

LOOK AT THE DIFFERENCE VAL-LITES MAKE ON THIS SERVICE STATION INSTALLATION!

Before VAL-LITES were installed, this was just another lubritorium.



Add VAL-LITES and . . . presto! . . . the work shop is a sales room, too!

Now get out front! See how the whole station radiates soft fluorescent light . . . by day or night . . . to bring customers in from the highway.

"THIS PAIR SAVED ME MONEY ON WIRE..."

THEY GOT IT HERE ON TIME! THEY KNOW THEIR WIRE... *they're experts!"*

Work crews don't stand idle when this pair is on the job. Orders are quickly delivered.

Prompt delivery is partly the result of having items stocked close to you. Mainly, however, getting you the right product at the right time stems from the teamwork of the U. S. Rubber salesman and the U. S. Distributor's salesman. Together, they make a pair that saves you time, money and worry.

If you run into a supply emergency, or have a tough time finding a hard-to-get item, call your Electrical Distributor or the U. S. Rubber Salesman.

They will also help you coordinate the specifications of architects and engineers, provide engineering and other specialized help relating to products and their applications. For this pair *know* their wire . . . they're experts.

Write today: Electrical Wire and Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y. You'll save yourself money.

U. S. ELECTRICAL WIRES AND CABLES FOR EVERY PURPOSE

The electrical distributor performs an indispensable function in distributing electrical products. He keeps inventories, provides billing, credit and other services—each of which reduces the cost of the electrical product to the contractor.

MADE BY

U.S.RUBBER

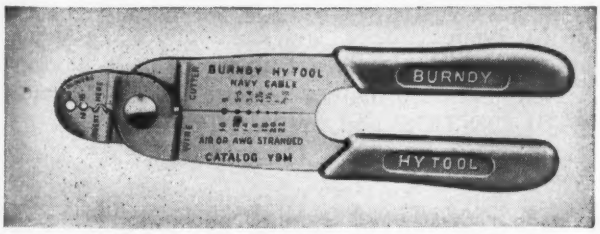
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

Tools that replace the Torch...

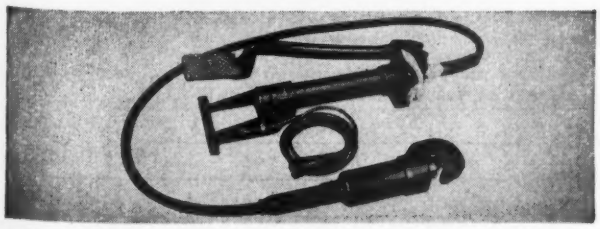
Burndy Hydraulic Hypress—Y34-A. Hand-operated—weight 9 lbs., 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm. Used to install Hylugs, Hylinks, Hytaps and overhead Hysplices.

BURNDY
Hytools and Hypresses



Burndy All-Purpose Hytool—Y9M. Hand plier with wire cutter and stripper. For conductors No. 22 through No. 10.

Burndy Hytool MY29. Hand-operated—for conductors No. 8 through 4/0 without change of dies.

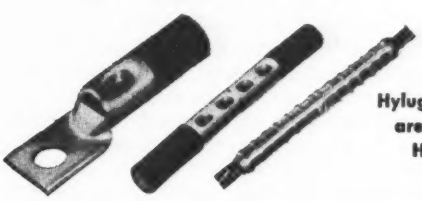


Burndy Hydraulic Hypress—Y34-B. Foot-operated type; 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm.

WHY fuss with solder when making electrical connections? Efficient, rapidly operated Burndy HYTOOLS and HYPRESSES indent one-piece, pure copper HYDENT connectors onto all conductors from #22 through 2000 Mcm.

With this modern HYDENT connecting method you assure uniform depth of indent, and *strong, efficient electrical connections, every time.* But more, you make substantial savings on *every* connection. You just insert the conductor into the connector barrel, and indent with the HYTOOL. *Nothing simpler . . . nothing quicker . . . nothing surer!*

No matter what your requirement, Burndy has the right tool for your connecting needs . . . hand, portable or bench types; manual, hydraulic or pneumatic operation. Get all the facts. Send for Burndy HYDENT Catalog Y46 today.



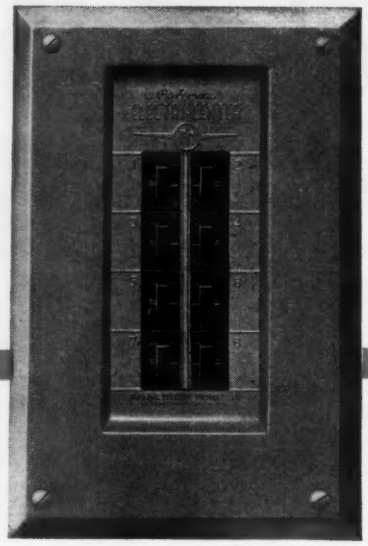
Hylugs—Hylinks—Hysplices are a few of the many Hydent connectors.

Connect with
BURNDY

New York 54, N. Y.
WESTERN BRANCH: Vernon 11, California

Here it is!

NEW BULLDOG
Service Electri-Center



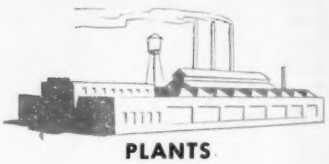
Available in 2-, 4-, or 8-circuit cabinets, the handsome Service Electri-Center is ideal for homes, offices, and small plants.

featuring *Pushmatic*

FOR HOMES

COMMERCIAL BUILDINGS

GARAGES



PLANTS

THE BULLDOG Service Electri-Center, featuring *Pushmatic,* offers ease of installation, versatility and adaptability *never before obtainable in any panelboard.* Here's why—

More compact than old-fashioned load centers, the Service Electri-Center actually contains more wiring space! Revolutionary *Pushmatic* units are responsible for this bit of magic. Two-thirds the size of a pack of cigarettes, *Pushmatic* makes the Service Electri-Center a wireman's dream.

And complicated group mountings are eliminated. Each *Pushmatic* is an individual single-pole unit, making changes and additions a simple matter.

BullDog Service Electri-Centers don't have to be hidden away in the basement or other inconspicuous and inconvenient places. Beautifully styled, this modern panelboard is at home almost anywhere.

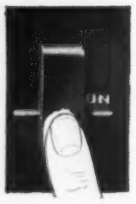
Available in 2-, 4-, and 8-circuit cabinets, the Service Electri-Center is the last word in efficiency and protection for homes, offices, and small plants. Send the coupon today for *Pushmatic* Bulletin No. 494. It contains complete information and prices on Service ELECTRI-CENTERS and the new *Pushmatics.*

Pushmatic... a new kind of control and protection

PUSH—It's ON!

PUSH—It's OFF!

PUSH—It's ON again!



THE revolutionary *Pushmatic* provides finger-tip control and automatic protection against short or overload. A simple push of the finger makes or breaks the circuit.

And if power is broken by short or overload, just push and service is restored. No more bothersome resetting by hand . . . no fuses to worry about. There's only one operation for this unique circuit breaker and that's PUSH!

There are four types of *Pushmatics:* THERMAL ONLY, THERMAL-MAGNETIC, or either of these types with AMBIENT COMPENSATING FEATURES. All *Pushmatics,* regardless of type or rating, are identical in size and contour and are interchangeable.

Approved by Underwriters' Laboratories, *Pushmatics* are available in ratings of 15, 20, 30, 40, and 50 amperes, 120 V., 1 pole, or 120-240 V., 2 poles, AC.

Send the coupon now for more information on why the sensational *Pushmatic* makes the BullDog Service Electri-Center the most modern panelboard available today.

BULLDOG ELECTRIC PRODUCTS COMPANY
DETROIT 32, MICHIGAN—FIELD OFFICES IN ALL PRINCIPAL CITIES
IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

BULLDOG

HEADQUARTERS FOR ELECTRICAL DISTRIBUTION

BULLDOG ELECTRIC PRODUCTS CO.
Detroit 32, Michigan

Please send me your Bulletin No. 494 giving full information and prices on your *Pushmatic* Service ELECTRI-CENTERS.

Name_____

Company_____

Street Address_____ Zone_____

City and State_____

F

AUGUST . . . . at a Glance

Television

The construction of television station WOR-TV focusses attention on a thriving new industry that holds tremendous promise for the entire electrical fraternity. Representative of the hundreds of new transmitters now being erected or planned, this installation is translated into terms of power distribution, controls, protective devices and a wide range of operating equipment. Hand-in-hand with this new industry are new installation techniques followed, during the WOR construction period, by the Beach Electric Company of Newark, New Jersey. This article begins on page 35.

Coil Production

Efficient coil-making is the heart of motor shop operations. Giles Armature and Electric Works, Inc., in Marion, Illinois, in the center of the Illinois coal fields, besides their large motor repair business, make coils for other shops on order, and maintains a large stock of coils ready to repair motors in the area. Gus Eckel's picture story of their coil winding operations shows many practical job ideas, beginning on page 48.

Reader Service

Beginning next month, several of the popular departments will appear in a new grouping and format under a new department title, "Reader Service." Our new Reader Service Department will include and bring together material now appearing under Equipment News, Trade Literature, Questions on the Code, and Reader's Quiz. We hope you will find the new arrangement more compact, easier to find, and easier to read. Watch for the Reader Service Department in September.

Specifications

The Master Electrical Specification which appeared in last month's issue contains a large amount of useful data. We hope from time to time to bring out revisions and new material to keep it constantly up-to-date. We shall very much appreciate your comments, criticisms and suggestions. They will help us develop further material equally useful and practical.

Recognition

In a recent editorial competition conducted by "Industrial Marketing," *Electrical Construction and Maintenance* received three awards for editorial excellence. The awards were for editorial achievement in three categories. For an outstanding single article, "Residential Wiring Costs" which appeared in May 1948, for an outstanding series of articles, "Volume-Duration Studies" by Ray Ashley, and for outstanding research, "Planned Lighting Design and Layout Data," October 1947, received awards of merit.

Sound Powered Phones

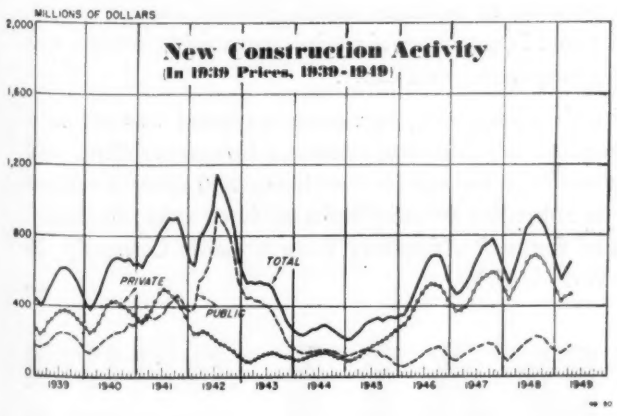
One of the useful developments coming out of wartime communications is the sound powered telephone system. Independent of power supply, sound powered phones are convenient and useful in many industrial and commercial applications. A. A. Schuhler's series on signaling and communications discusses sound powered phone applications beginning on page 46.

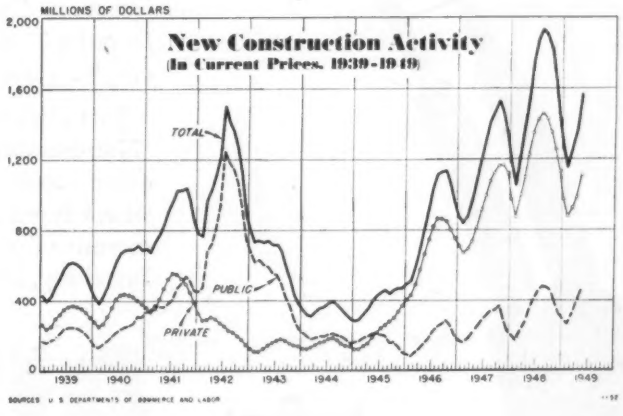
Hazardous Area Wiring

Wiring methods and materials around chemical plants must be developed with careful consideration for explosion-hazardous areas. A New Jersey chemical plant wired by Watson-Flagg contains many examples of modern explosion-proof and vapor-proof wiring applications. The article "Explosion-Proof Wiring" by Ralph C. Hodges, beginning on page 44, tells the story.

Planned Lighting

How planned lighting techniques can be applied by electrical contractors is exemplified by "Louver Ceiling Relights Bank" by Parkes and Thompson, beginning on page 42. The project, a bank, offered an unusual challenge. The eventual lighting results from careful planning were both dramatic and effective.





Some names are important...here's one to remember...

DURALL
THE FARMER'S FRIEND
TO CONTRACTORS:
Here's a new product, a good product and a *needed* product that you can sell to *both* old and new customers... who are reading about it now. See your Anaconda Distributor *quick!*

WHEN Durall goes in... worry comes out... of *any* barn or farm building. Anaconda Durall Cable... a name to remember... is the new, Underwriters approved, completely reliable barn wire.

Durall is a non-metallic-sheathed wire with a rubber-like insulation of Neoprene and a heavy protective jacket of the same tough, flame-resistant material... with no fibrous coverings to rot or fray.

Durall is strong electrically and physically. Both insulation and jacket are highly resistant to moisture, mold, rot and animal wastes. Durall will not support flame, is proof against most acids, alkalis and oils. This is a truly fungus-resistant cable.

The Underwriters' Laboratories, Inc. have approved DURALL as a "Non-metallic-sheathed cable having adequate fungus-resistant, and other necessary properties for use in cow barns and *other* locations where it would be subjected to conditions of heat, cold, moisture, corrosive fumes and fungus." Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

49453

ANACONDA
from mine to consumer

DURALL BARN WIRE

TALK ELECTRIC HEATING

GOLD BADGES and souvenir programs at Saranac Inn last month symbolized the fiftieth anniversary of the New York State Association of Electrical Contractors and Dealers. It was an occasion for good talk and quiet pride in the accomplishments of an organization that has given so much of its men and its ideas to the whole electrical industry. A better measure of the temper of the group, however, was the keen interest and active discussion on electric heating; a field as open and challenging today as any our old timers faced at the turn of the century.

ELECTRIC HEAT deserves critical study by electrical contractors, particularly the revolutionary new low temperature radiant systems. A lot of new and unfamiliar words and phrases are finding their way into our already complicated electrical language. We must understand heat losses. "Transmission", "insulation" and "efficiency" are acquiring other meanings. Such units as B.t.u.'s, square feet of steam radiation, and degree days are comparatively new to the field of electrical utilization.

TO DESIGN, install and wire modern electric radiant heating systems takes a fair amount of engineering. The complexities are of about the same order as competent wiring system design but based upon other units and factors. These very early days of electric heating development offer a good time to inquire into conventional heating nomenclature and method. How much do we actually need for proper application and effective selling?

THE B.T.U. AND THE KWH. are energy units readily interchangeable. A lot of unnecessary confusion can be avoided by the conversion of essential tabular material and formulas expressed in or using the British thermal unit to our more familiar and equally useful kilowatt-hour. Further, many of the calculations involved in heating system application can be considerably simplified, since we are dealing with an already highly refined energy. Electricity is directly convertible into useful heat under accurate control at precise design temperature without loss or waste in the process.

USEFUL LIFE, depreciation and maintenance considerations for electric panel radiant heating are entirely new in the heating field. Beyond occasional defects which are usually covered in original installation guarantees, they are practically negligible. It is entirely reasonable to expect such a system to operate satisfactorily over a very long period without repairs or replacement.

MANY PROBLEMS, engineering and economic, must be solved before we can install more than "luxury" applications of electric space heating to homes. But critical engineering analysis and effective salesmanship could establish many commercial and industrial applications now. It is not too soon for the electrical construction industry to develop a heating terminology and to talk electric. It is significant indeed that an industry group can face its second half century with a single new market project potentially greater than its whole past accomplishment.

Wm. F. Stuart

Keep Business Buzzing

with signaling via Graybar

Show your customer how, with a flick of a lever, he can "buzz" or talk to anyone, anywhere in his plant. Point out that clear, fast communication among various departments saves many hours of time ordinarily lost in locating personnel, issuing urgent orders and checking operations. Then remember that Graybar has all the voice or code-paging equipment you need to fill your contract quickly and efficiently.

From "intercom" to siren

There's Webster Electric Teletalk, an amplified communication system that connects him directly with personnel at selected points in his plant. It relieves switchboard congestion and saves countless steps through two-way or multiple inter-office conversations. There's the Edwards Lokator, a paging system that speeds location of personnel throughout the plant. Installations can be made with a wide variety of signals — from buzzers, musical notes or silent flashing lights to bells, horns, or howlers that will penetrate any plant noise. Or he may like UIS Sound-powered Telephones. For common or selective talking systems, these handsets transmit distortion-free conversations over long circuits without external power! A rugged weatherproof set is available with magneto howler signals. For warning, Graybar has Benjamin and Federal sirens. The coupon below will bring you details.

Expert help in planning

There are Graybar offices in more than a hundred cities. Your local Graybar Representative will give you complete information on all types of talking, calling, warning, and locating equipment. A Graybar Signaling Specialist will gladly work with you in choosing the best combination of devices and accessories for any installation. We offer you similar service in the selection and procurement of supplies for lighting, wiring, ventilation, and other electrical installations.

Send coupon for folder

4972

GRAYBAR ELECTRIC COMPANY, INC.
420 Lexington Ave., New York 17, N. Y.

Please send me your free illustrated folder, "Signaling and Intercommunication Systems for Every Need."

Name _____ Title _____

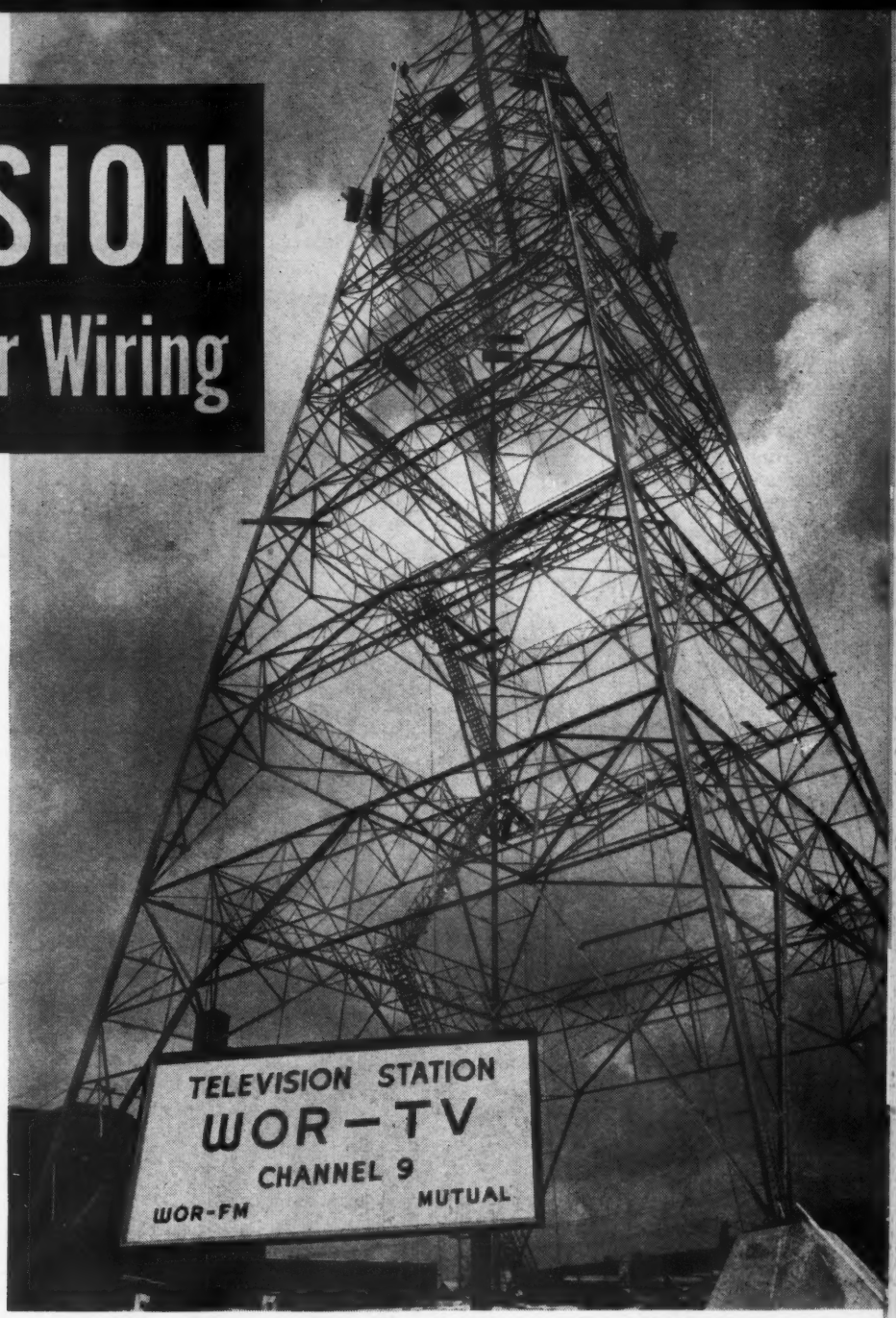
Company _____

Address _____

You get the best of everything electrical
via GRAYBAR

TELEVISION
New World for Wiring

Beach Electric Company's exacting electrical installation at Station WOR-TV emphasizes the new terminology, new know-how, new techniques and new wiring opportunities of television.



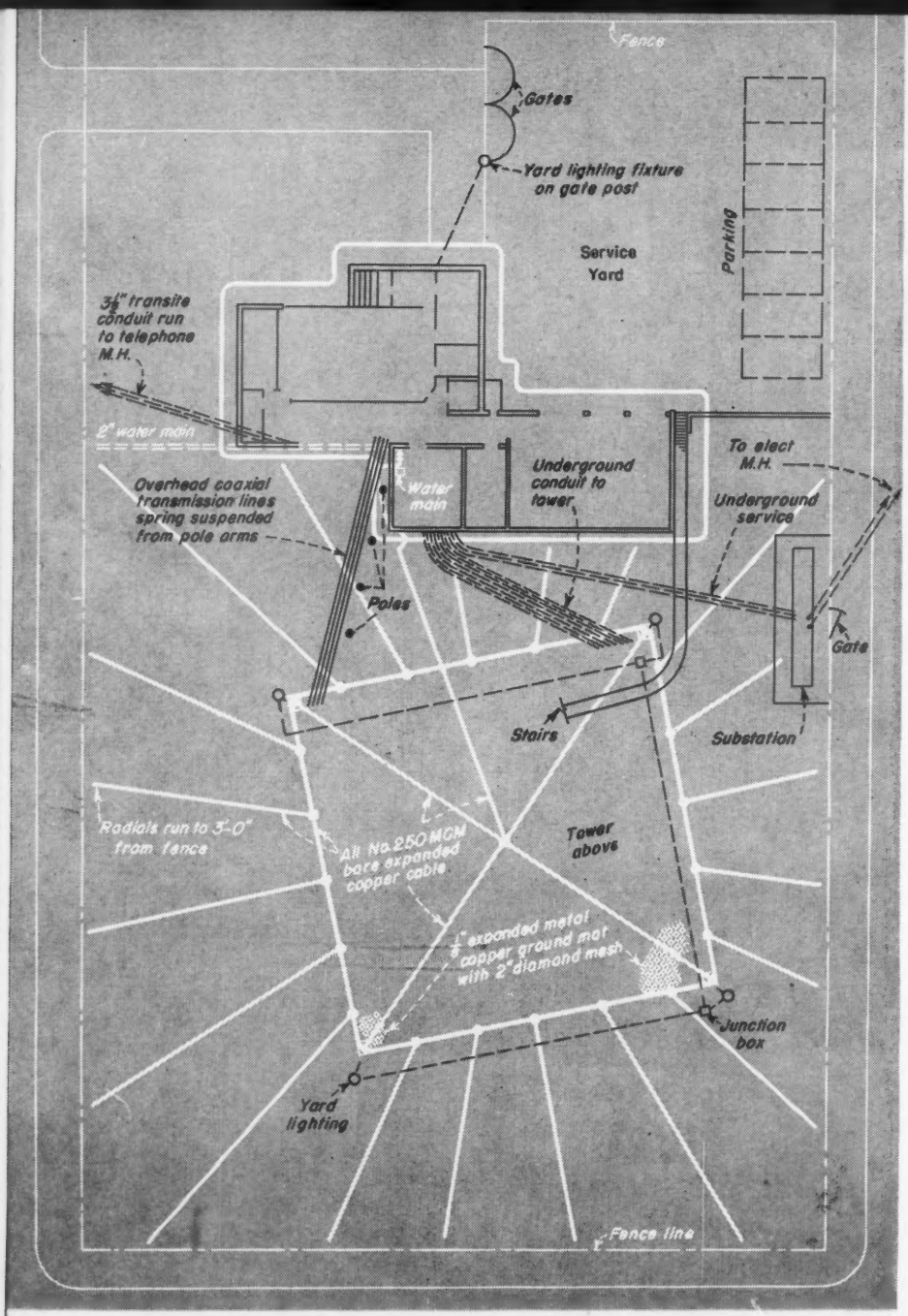
TRANSMITTER TOWER *reaches the 290 foot level in its 810 foot climb above the North Bergen Palisades. Coaxial cables for both TV and FM will be carried upwards along the southwest (left) leg, while cables for power, lighting and low-potential use will rise in conduit along the northwest (rear) leg. Corner platforms are designed to carry obstruction lights and beacons.*

By
Hugh P. Scott

EVERY new TV transmitter is an important and exacting electrical construction job; representing huge investments in wiring, controls, protective devices and equipment. And the growth of this relatively young industry has been fantastic; evidenced by the number of transmitters being placed in operation. For stations totaled only 7 in mid 1946, then 16 by the first of '48, then 49 by the first of the present year, and 62 in May. In addition, 57 construction permits are now in effect, and 325 additional applications await approvals by the F.C.C. Growth likewise is evidenced by the number of receivers. For fewer than 200,000 sets existed in this country prior to 1948. This total exceeded the million mark a year later, and today the country's 75 TV manufacturers are collectively producing more than 180,000 sets a month. Future predictions vary widely. But conservative estimates place the transmitter total around the 300 mark and receivers above 6 million by 1951.

With the completion last January of the Bell System's $12.5-million underground coaxial cable between Philadelphia and Cleveland, 16 major cities from Boston to St. Louis became linked for network television programming, and nine additional areas will join this grid by the year's end. Connected by 1740 miles of coaxial cable and the 370 miles of radio relays now in service, transmitters already serve areas occupied by approximately 40 percent of our population and, with UHF just around the corner, this coverage will rapidly expand.

Representative of the industry's growth is station WOR-TV, key station for the Mutual Broadcasting System, which officially goes on the air this month. The word "official" is used advisedly, for WOR has been telecasting experimentally since 1943, begin-



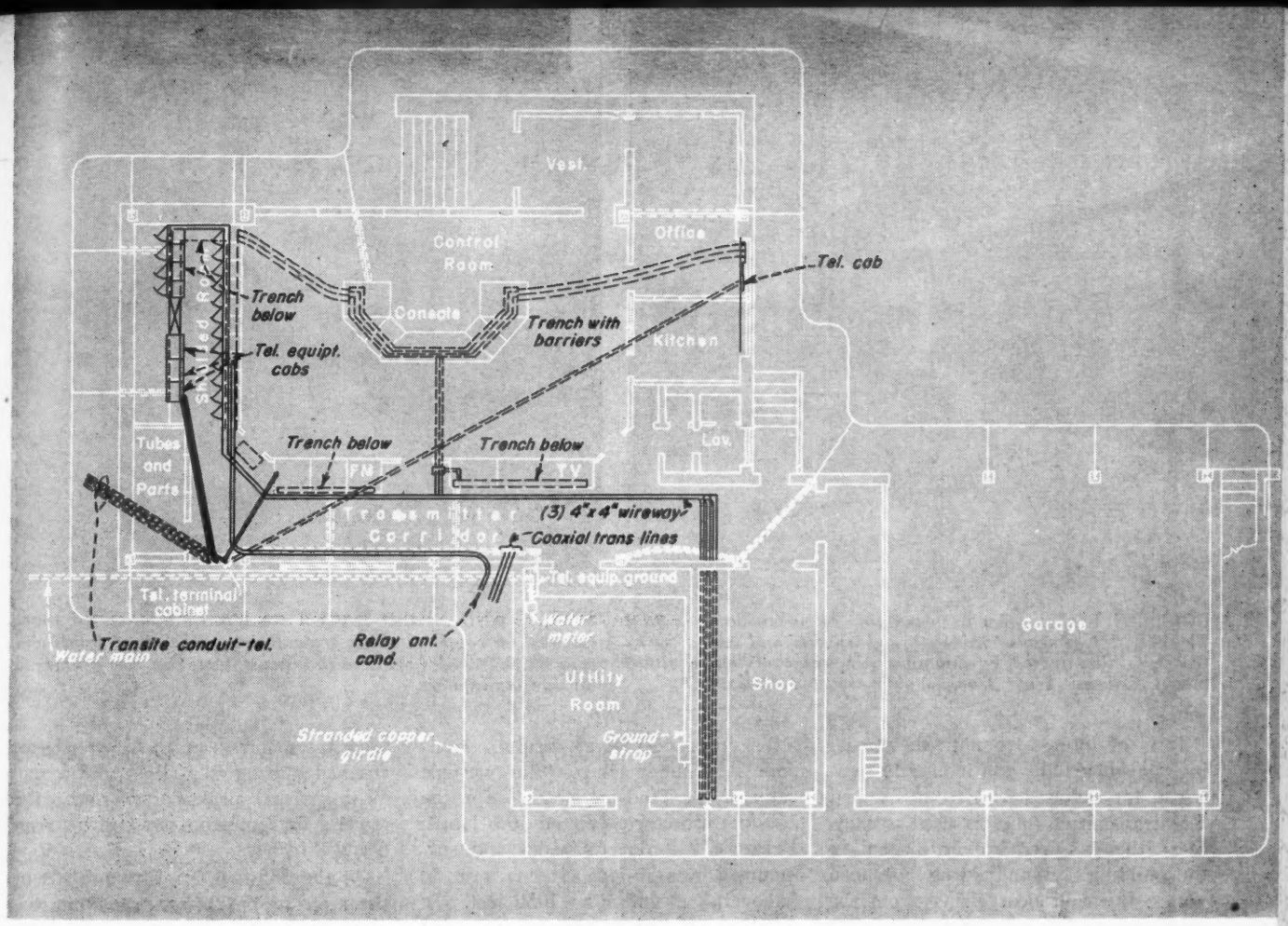
GROUNDING SYSTEM ***girdles transmitter and tower, with radial runs extending to fence line. Expanded metal ground-mat covers entire area beneath tower, and all equipment, structural steel, electrical fittings and other metallic materials are positively bonded to main grounding system.***

ning a period of apprenticeship rich in valuable experience for their technicians, program staffs and telecast personnel. Application for a commercial television station was filed with the F.C.C. in January, 1942; a construction permit was granted in October, '45; extensive testing of possible sites led to the purchase of a plot of ground in North Bergen, N. J., in June, '48, and ground was broken for the new transmitter August 30th of last year. Ground was broken with a golden pneumatic hammer—a modern tool symbolic of a modern industry—instead of the traditional pick and spade.

The transmitter building, designed by the architectural firm of Voorhees, Walker, Foley and Smith of New York City in cooperation with the WOR engineering department, and constructed by general contractors Mahoney-Troast of Passaic, N. J., incorporates a large control room, shielded speech and video racks, transmitter bay, work shop, storage room, kitchen, washroom, office, 3-car garage to house the station's fleet of mobile transmitters, and service rooms where electrical distributing, heating, pumping and air conditioning equipment is located. One story in height; of brick and glass construction, and covering 5000 square feet, the modern structure is situated on a landscaped tract adjacent to the 800-foot broadcasting tower.

To insure continuity of primary power, incoming utility service is through two separate feeders fed from different substations in the Public Service Electric and Gas Company's network. Each primary feeder serves three 50-kva. 440-120/208 volt 3-phase 4-wire outdoor transformers having cross-connecting and network-protecting equipment on the secondary side. Connections between outdoor substation and interior main service switch, metering equipment, circuit breakers and main switchboard are through twin 3½-inch underground conduits each carrying four 350-MCM RW cables. Circuits from the main board feed racks and transmitter panels as well as building, tower and yard lighting and power panels. Branch circuits from these control points are cable-conduit runs, all cable being Type R of 12-gage or larger, and conduits ranging from 3½ down to ¾-inch in diameter. Power and lighting circuits for the tower are also carried in conduit, running underground to the tower base, then upwards along the tower's northwest leg. There are also extensive runs of underfloor duct, steel raceways and plate-covered floor trenches to distribute power, high and low signal circuits and telephone lines. Telephone and program lines enter the building underground through three 3½-inch transite ducts, while coaxial transmission lines between the transmitter building and the broadcast tower are air-borne; spring-suspended from standard creosoted pole arms spaced at 15-foot intervals.

Perhaps the most unique and outstanding feature of the entire electrical installation is the comprehensive grounding system. This system, thoroughly covering more than an acre, rings and connects the transmitter and tower, establishing a continuous ground between all conduits, bushings, couplings, junction boxes, panel boxes, wireways, metal trench liners, structural steel, transformer tanks, and every piece of metallic equipment and material within the fenced confines of the station plot. In addition to the main girdling ground system, consisting of 250-MCM bare stranded copper cable run on the surface over rock or buried 18 inches beneath the soil where conditions permit, 20 additional grounding lines radiate outward from the tower's base to within 3 feet of the fence lines, and an expanded metal copper ground mat with a 2-inch diamond

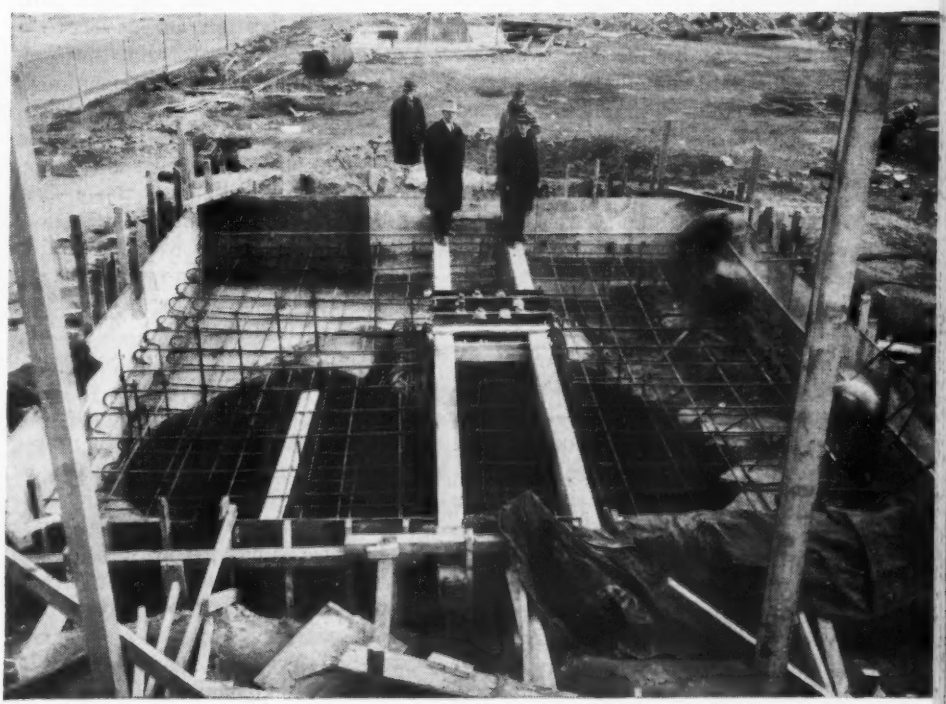


TRANSMITTER BUILDING, *circled by bare stranded copper grounding girdle, has distribution system consisting of floor troughs, raceways and conduits. Beach Electric Company followed latest methods while installing grounding system, coaxial cables, electrical equipment and wiring network.*

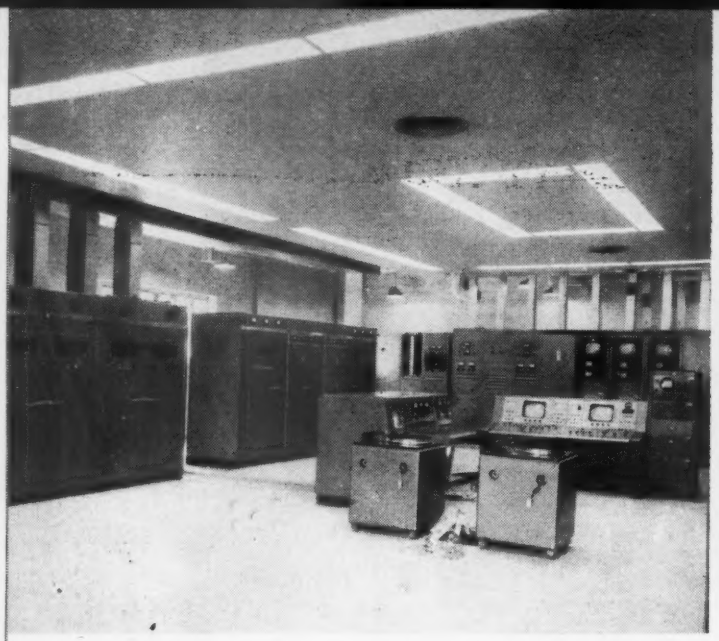
mesh covers the entire area bounded by the four tower legs.

Building and interior equipment ground ties are No. 6 bare stranded copper cable, brazed to the grounding girdle. Building ties are lug-terminated at building columns while interior equipment ties are run direct from copper flashing grounding mats to the girdle in ¾-inch conduit. All connections, bushings, wireways, etc., are tack-welded to insure continuity of grounds. Service switches and work benches are grounded by flat copper straps, while telephone equipment is grounded to the water system by 8-gage bare wires in conduit.

Lighting for the control room, office, foyer, dining room and kitchen is fluorescent, with 2-lamp 40-watt flat-lensed units recessed into the acoustical tile ceiling, and with line filters connected to each fixture to eliminate radio interference. All other areas in the building, around the grounds and on the tower are illuminated by incandescent fixtures, principally RLM in utility areas, ornamental in public spaces and special design for specific applications.



REINFORCED CONCRETE FOUNDATION *for the 420-ton steel tower is imbedded in solid granite and weighs 2000 tons. Each leg is anchored by 8 case-hardened steel bolts, each weighing 800 pounds and extending into the concrete base 13 feet. Due to rock foundation and also symbolic of modern construction field, gold pneumatic drill was used to break ground, replacing traditional pick.*



CONTROL ROOM, *prior to installation of curtain walls around TV and FM transmitters (left) and speech and video racks (rear), is illuminated by 2-lamp ceiling-recessed lensed fluorescent fixtures. Floor troughs carry low-potential wiring.*

SPEECH AND VIDEO RACKS *are located in shielded room and rest on copper flashing ground mats with brazed joints and connections. Spill heat rises to exhaust ducts that carry fumes to outside atmosphere.*

It is of interest to note that heating is also partially and indirectly electrical, for radiated heat from TV and FM transmitter tubes is used to augment the gas-fired hot-air system in the building. By adjusting overhead vanes, the spill heat rising from the tubes can either be shunted into the electrostatically-filtered air-intake duct where it mixes with incoming fresh air, it can be carried directly into the garage, or exhausted into the open air, depending upon heating requirements dictated by seasonal changes and temperatures within the structure. This hot air distribution is through the same series of ceiling-flush ducts designed to circulate water-chilled air during warm weather. It should be emphasized that, although spill heat from transmitters is at times recirculated for general heating purposes, undesirable heat from speech and video racks is always exhausted directly into the outside atmosphere.

Utilization of power is varied; including that used for audio-rack and transmitter cubicle blowers, exhaust fans, water pumps, anode coolers, door operators, air conditioning units, dehydrators, antenna sleet melters, speech rack circuits, lighting, kitchen equipment and receptacle outlets for such equipment as control console apparatus, power tools, clocks, unit heaters and other auxiliary accessories. And distribution for tower lighting and power application increases this extent, with both feeder and control circuits rising from the ground-based transmitter building to a glass-enclosed control house constructed at the tower's 555-foot level.

The huge steel tower creates a dominant new landmark on the western bank of the Hudson River. For the 760-foot structure, erected atop North Bergen's 240-foot Palisades and surmounted by a 50-foot antenna, rises to an overall elevation of 1050 feet. In addition to being impressive, this height is important to successful telecasting for, since effective transmission adheres to sight-line limitations, height is vital to wide-range coverage. This factor of height, together with WOR-TV's location outside of New York City's environs of ghost-producing tall buildings, guarantees maximum clarity of reception throughout the metropolitan area served. And it also is significant to note that this area, conservatively estimated as falling within a 50-mile radius of the station, has a population of over 12-million people; representing an impressive potential audience in New York, New Jersey and Connecticut.

Designed by the Lehigh Structural Steel Company of Allentown, Pa., and erected by Terry Steel Contractors, Inc., of New York City, the tower weighs 420 tons and consists of four legs, spaced 96 feet apart at the base and 5 feet apart at the top. This mass of steel is supported by a 2000-ton poured-concrete base which in turn is imbedded in solid granite. Anchorage for the tower is provided by 32 case-hardened steel bolts, each weighing 800 pounds and extending 13 feet into the concrete base. The giant structure, with an extremely low natural period of vibration, is designed to withstand winds up to 120 mph., although the highest recorded wind velocity for the area has so far been an 81-mph. peak reached during the 1944 hurricane. With normal peaks of 35-mph., the tower's extreme top sway is between 6 and 8 inches.

At the 555-foot level, two-thirds of the way to the tower's summit, the glass-enclosed micro-wave relay station can pick up broadcasts from the station's mobile units, thus making it possible to rebroadcast sports events and other programs of interest not originating in the WOR New York City studios. These signals are relayed coaxially to the ground-based transmitter where they are rebroadcast for public reception.

Also contained in this glass-enclosed station are control panels for tower beacon and obstruction lights, hoist equipment for raising equipment, unit heaters and powered maintenance tools.

Tower lights, including flashing beacons and constantly-burning obstruction lights, can be controlled manually or by light-sensitive photoelectric relays that automatically place lights in service whenever darkness limits permissible C.A.A. visibility. In addition to these lights and the C.A.A. color pattern of alternate International orange and white painted sections, the New York City side of the tower carries the station's call letters; the 30-foot high letters outlined in neon being visible in clear weather for 25 miles.

Cables for light, power and low-potential purposes are carried upwards along the northwest leg of the tower in 12 conduits ranging up to 3½-inches in diameter. Galvanized junction boxes, positioned every 100 feet, serve the

[Continued on Page 116]

Wiring the LUSTRON HOME

Seven electrical circuits are installed in Lustron's two-bedroom all-steel prefab house as standard equipment. Local electrical contractors supply and install outside service and make final connections at outlets, fixtures and switches.

ELECTRICITY plays a major role in the compactly-designed five-room Lustron home, engineered to meet the demands of modern living, and now in production in the Lustron Corporation's 1,100,000-square foot plant at Columbus, Ohio. Important appliances are included in the completed two-bedroom home and 23 outlets, scattered throughout the house, permit abundant use of various types of portable lamps and other electrical equipment.

The electrical system comprises seven electrical circuits for the two-bedroom home as standard equipment, plus a telephone outlet box and conduit to the entrance point.

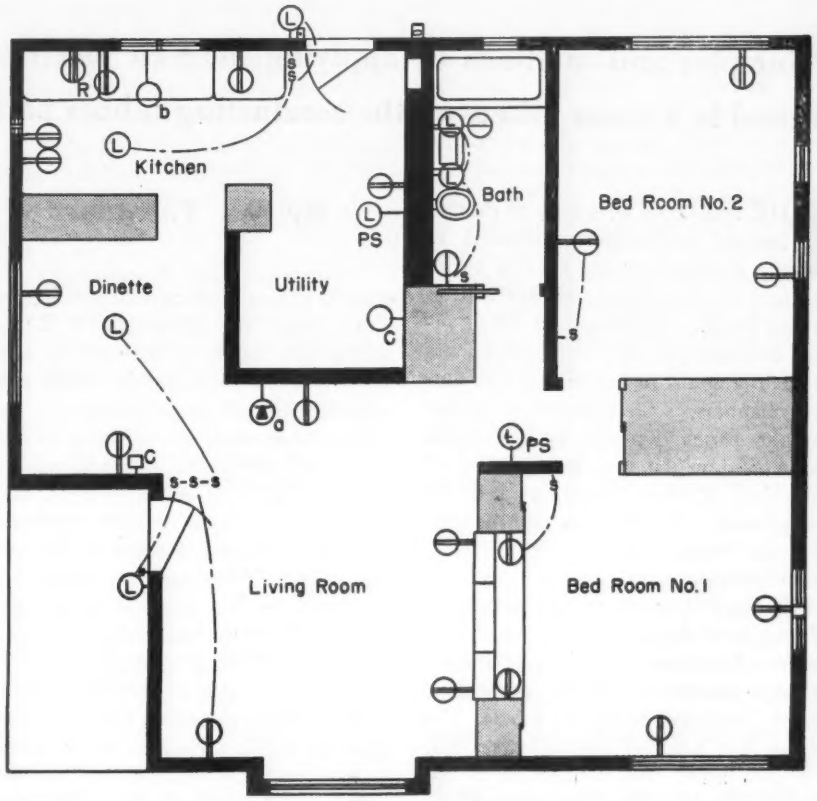
All wiring is done in Type AC armored bushed cable, except for high temperature areas where Type AVA in half inch flexible conduit is used. Factory installed in the wall sections, all materials and workmanship comply with the latest National Electrical Code standard of the National Board of Fire Underwriters.

All lighting fixtures are furnished with the house, and are of the incandescent lamp type. A shaded fixture for 3/60-watt lamps is used in the kitchen. The dinette is lighted with a semi-indirect fixture for 2/75-watt lamps. The utility room has one wall-mounted bracket for 2/60-watt lamps. A wall-mounted bracket for one 60-watt lamp lights the hallway and is equipped with a full switch. The bathroom contains 2/40-watt tubular lamps with a receptacle attached to the wall cabinet, and one 60-watt wall-mounted shaded fixture. The two entrances are each lighted with a 60-watt lamp bracket, units being shaded.

A Thor automatic combination sink, dish and clothes washer, and an exhaust fan are standard equipment.

A 50-gallon automatic electric water heater (or 30-gallon automatic gas tank, if preferred) is furnished with the home. It is located in the utility room, which also houses the electronically-controlled ceiling radiant heating unit.

The Lustron house is completely wired at the factory, including the master switch box. However, the local electrical contractor supplies and installs the service wire, from the utility pole to the house, and makes all connections at the convenience outlets, fixtures and switches.



LUSTRON HOUSE FLOOR PLAN
Showing Electrical Outlets

SYMBOLS

- Single receptacle
- Duplex receptacle
- Range receptacle
- Lamp holder
- Entrance panel
- Lampholder with pull switch
- Telephone outlet box
- Automatic sink outlet
- Door chime
- Water heater outlet
- Single pole switch
- Push button chime
- Meter

ELECTRICAL WIRING SYSTEM includes seven electrical circuits, which are factory-installed in walls. Electric range and hot water heater are on separate 220-volt circuits.

ELECTRICAL CIRCUIT SPECIFICATIONS

Circuit	Description	Amperes	Size of Conductors	Volts
1	Lighting	15	No. 14—2 wire	110
2	Lighting	15	No. 14—2 wire	110
3	Heating System	15	No. 14—2 wire	110
4	Range	50	No. 6—3 wire	220
5	Water Heater	20	No. 12—2 wire	220
6	Appliances	20	No. 12—3 wire	110
	Dishwasher	20	No. 12—2 wire	220
7	Door Chime		No. 18 Bell Wire	10

ELECTRICAL RADIANT HEATING

Principles and methods of applying modern electric space heating. This article, second in a series, discusses the conducting rubber panel type of heating installation.

By W. T. Stuart

THE resistance wire type of radiant heating installation discussed in the previous article of this series has had its most extensive application in the Pacific Northwest. A more recent development, of which components are available through national distribution channels, is the conducting rubber radiant panel. Known by the trade name "Uskon", it is a development of the U. S. Rubber Company and the components are distributed through Graybar supply houses. (E. C. & M. June 1948)

The system involves heating panels of standard dimensions in which the source of heat energy is a layer of electrically conductive rubber sealed between insulated layers of fabric. The panels are finished components ready for installation and connection to the wiring system. They are designed for application to the ceiling in the areas to be heated.

Radiant panels may provide:

1) Full heating requirements (even in the coldest climates);
2) "Comfort control" heating, in which some portion of the heat requirement is provided by fuel burning sources; and
3) Supplementary heating of special areas where the precise control and convenience of electric radiant heating is particularly advantageous.

Uskon panels are available in two standard sizes, 4 ft. by 4 ft. and 3 ft. by 4 ft. They operate on 220 volts. Two wattage densities are available, 17 watts and 22 watts per square foot. Heat output is 58 B.t.u. per sq. ft. for the 17 watt panel and 75 B.t.u. per sq. ft. for the 22 watt panel. Power consumption of the 4 by 4 panel is 272 watts at 17 watts per square foot and 352 watts at 22 watts per square foot.

Heating panels are installed in the ceiling to obtain the maximum degree of radiant heat. In new construction, the panels are nailed directly to the ceiling joists after the framework of the house is completed. The 17-watt (58 B.t.u.) per square foot panels are used in rooms with normal heating requirements; the 22-watt (75 B.t.u.) panels are used in bathrooms, over large window areas and in rooms with abnormally high heat losses.

The electrical connections to the panels are made with standard building wire of the armored cable type, nonmetallic sheath type or with rigid conduit. The standard method of connecting panels is through an outlet box furnished on the back of each panel within which the lead wires are connected to electrical binding posts contacting the rubber resistance layer. When rigid conduit is used, a short piece of flexible metallic armor should be connected between the junction box and the end of the conduit. This flexible connector prevents a strain being placed on the junction box during installation and also prevents the expansion and contraction stresses of the conduit from being transmitted to the junction box during operation of the panels.

Two-story homes present a special problem insofar as the junction box is concerned. The National Electrical Code specifies that all junction boxes be accessible for inspection. If the inspector will not approve concealing first floor panel junction boxes, pigtails may be soldered to the terminal binding posts, bringing the other end of the pigtails into an accessible feeder box mounted in the baseboard of the room above. Standard building wire may be used for the pigtails. The accessible feeder box permits trouble shooting if necessary.

Where there is no available space above the panels to permit wiring the connections, the panels should be wired before nailing them in position. Pigtails are connected to the terminal lugs in the junction box and brought to an accessible feeder box. The panels are nailed in place after the pigtails are connected to the panel.

The heating panels are connected in groups of parallel circuits. Five circuits are usually required in an average home. The total connected load to heat an average five-room house will be approximately 12 kilowatts. This is equivalent to the connected load for 1¼ electric cooking ranges. The total current carried by any one heating circuit will not exceed 20 amperes.

Panels are attached to the underside of the ceiling joists by either nails or screws. Since the panels are a permanent installation, it is recommended, as good construction practice, to provide an equal number of nails or screws on all four sides of the panel. This requires the installation of cross supports between ceiling joists along two sides of the panel. Due to the extreme hardness of the panels, they must be pre-drilled before fastening. Holes should be drilled in the neutral area on six- to eight-inch centers. To insure a permanent and secure ceiling, a hardened nail of the spiral type should be used when nailing the panels. As an alternate to a hardened spiral nail, any cement coated nail may be used. A nail of approximately 1¼ inch in length is recommended. Nail heads should be inset flush with the surface. If screws are used, the pre-drilled holes should be countersunk.

Arrangement of Panels—The most desirable arrangement for panels is a peripheral pattern with the center part of the ceiling being filled in with any standard building board. In small rooms of limited ceiling area, the panels are centered within the room. The entire ceiling of a room is not covered except in extremely small rooms or in rooms with abnormally high heat losses. The peripheral pattern is advantageous in that it provides a greater degree of direct radiation to persons within the room and it provides a slight air circulation which is desirable from a comfort standpoint. The slight air circulation created by peripheral arrangement of panels is particularly desirable in dispersing tobacco smoke and kitchen odors.

The 22-watt per square foot panels are always installed over large window areas and in bathrooms. Although

certain rules may be followed, generally, each room represents its own problem in panel arrangement.

The most difficulty in installing panels will be met in small rooms with high heat losses. This problem arises in entry ways (due to the high door loss) and in bathrooms. When it is absolutely impossible to provide enough heat with the available ceiling area, a panel is installed just outside the room over the door.

The infiltration of air around windows and door cracks is generally considered enough ventilation in residential homes. Approximately 55 cubic feet per hour leaks through each foot of weatherstripped door crack and 30 cubic feet per hour through each foot of weatherstripped window crack.

In large rooms the distribution of heat to all parts of the room is the important factor in arrangement of panels. Although the peripheral pattern is the most desirable arrangement, heat losses from certain rooms sometimes require covering the entire ceiling with panels. In any case an excessive number of 22-watt panels should not be installed in rooms of 8 feet ceiling height.

It is important that a 16 inch margin be provided around each panel pattern when possible in order that the entire pattern may be moved to conform to joist spacing. Initially it is necessary to start nailing panels on an existing joist, if the installation of special joists is to be avoided.

When arranging 3 ft. by 4 ft. panels it is important to keep the 4 ft. dimension running across the joists since the 3 ft. dimension (36 in.) does not permit fastening the panel to joists on 16 inch centers without installing a special support.

Where peaked roofs or other off-standard ceiling constructions are encountered, the manufacturer should be referred to for advice. With peaked roofs, the panels are generally installed at the lower levels of the roof. If beamed ceilings are encountered, Uskon panels can be made to special sizes as long as the 4 ft. dimension either way is not exceeded.

Controls—To obtain the maximum sensitivity of control, a low voltage thermostat must be used for controlling each room circuit. The manufacturers recommend type HNC Sensatherm with a temperature range of 55° to 85° F. If desired a temperature range of 40° to 70° is obtainable. The thermostat for each room has an "off" position which permits disconnecting the circuit completely when the particular room or area does not require heat. The standard finish on the cover of this thermostat is Alumlite, a polished aluminum finish. However, for economy of operation with radiant heat, a black cover or a painted cover is recommended. The black cover may be obtained from the supplier if specified. Thermostats should be mounted at a 50 in. to 60 in. height on a wall representing average temperature of the room; that is away from stoves, refrigerators, etc.

Operation of Thermostats

The operating temperature differential of the thermostat used with Uskon panels must not exceed ½ degree F. High voltage thermostats, with their greater inertia of sensitive parts, will not give the operating differentials required and only the more sensitive low voltage thermostats are recommended. Uskon panels warm the surfaces of the room, as well as the occupants, when the panels are "on". When the panels are "off", these warm surfaces continue to radiate heat and maintain comfort within the room. However, the panels cannot remain "off" too long or the room surfaces cool down. Therefore, a sensitive thermostat, ½° differential, is an absolute necessity for an Uskon installation. When thermostats with excessive operation differentials are used, discomfort is felt from high radiation peaks and low-temperature troughs.

In addition to the thermostat a relay-transformer must be provided with each control circuit. This relay-transformer is specified as a type V2-26F., 4000 watt, relay-transformer for operation on 220 volts.

The wiring diagram for the thermostat and relay-transformer is mounted inside of the relay-transformer cover. Relay-transformers should be mounted as a group in any convenient indoor location such as the basement, attic, attached garage or utility room. They should not be mounted on a closet wall or room in the living areas which might act as a sounding board to amplify the slight hum present in the unit. This hum cannot be heard if mounted on a surface which does not act as a sounding board.

The control arrangement is connected to suit the living habits of the homeowner. Since the relay-transformer is limited to 4000 watts, this capacity cannot be exceeded on any one circuit. However, an 8000 watt relay-transformer may be obtained, if required for a particular application. A thermostat and transformer-relay is required to control each circuit. A typical six- or seven-room house usually has the living room on one circuit, the kitchen and dining room on a second circuit, the master bedroom and bath on a third circuit, the two additional bedrooms on a fourth circuit and the halls and any additional rooms on a fifth circuit. With a thermostat on each of the above circuits, maximum flexibility of control is obtained. Since the optimum comfort temperature varies between individuals, the temperature of individual rooms can be lowered or raised, depending upon the occupant's preference. It is also possible to turn unused rooms off if desired.

For preliminary cost estimating, assume that 60 to 70 percent of the ceiling will be covered by panels. Select the percentage from the following table:

% Coverage	*Design Temperature*
70	−15° and lower
65	−10°
60	−5°
55	−0° and higher

Divide the area in square feet by 16 to obtain the approximate number of 4 ft by 4 ft Uskon panels. Example:

Design temperature − 10° F: Ceiling area 1500 sq. ft 1500 × 65= 975 sq. ft = 60.6: 61 panels.

Multiply the number of panels by unit price to obtain approximate total cost of panels.

To the preceding must be added the cost of wire, controls and labor of actual installation.

Design temperature is the lowest temperature on record with the local Weather Bureau plus 15°F. Example:

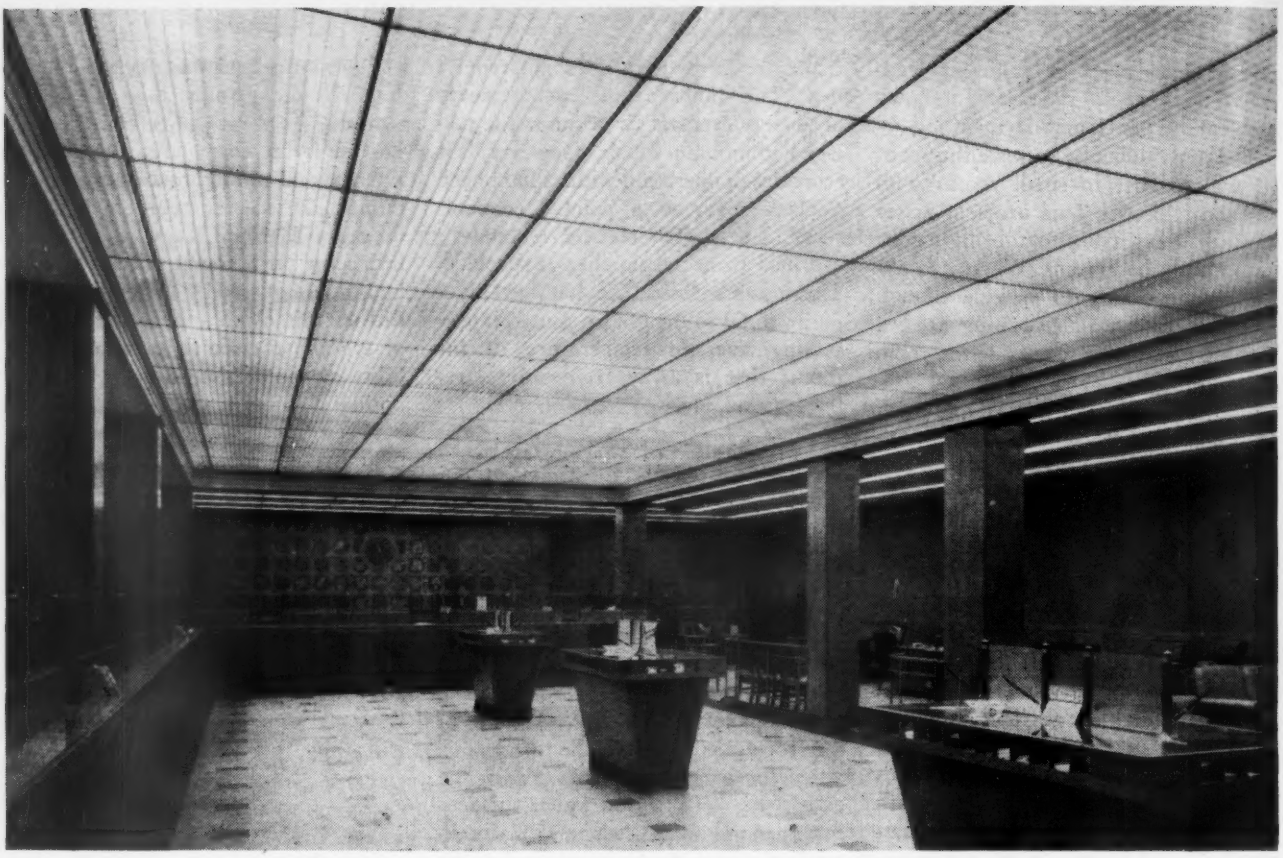
If the lowest temperature on record is minus 25°F, design temperature would be minus 10°F. If the lowest recorded temperature is minus 10°F, design temperature is plus 5°F.

The following formula will determine annual operating costs: Annual Kilowatt-Hour Consumption—

$$.3 \times \text{Cubic Footage of House} \times \frac{\text{Degree Days}}{1000}$$

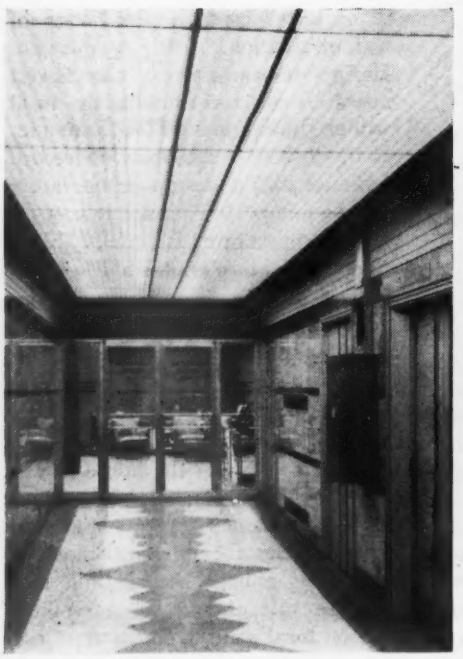
The cubic footage of the house is calculated by using outside dimensions in plan. The annual kilowatt-hour consumption times the rate per kilowatt-hour equals annual heating bill. The applicable rate should be determined from the local utility company.

The preceding formula is premised upon proper insulation of the house and the use of storm windows, etc.

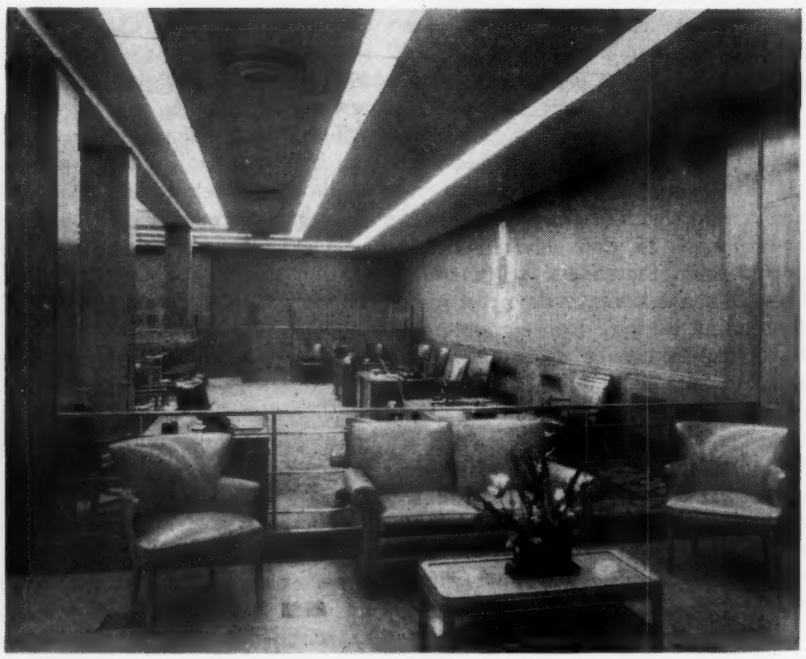


CUSTOMER AREA LIGHTING *consists of Vinylite plastic louvered ceiling with 300 ma. slimline lamps installed 24 inches on center 18 inches above louvers. Intensity is over 75 footcandles.*

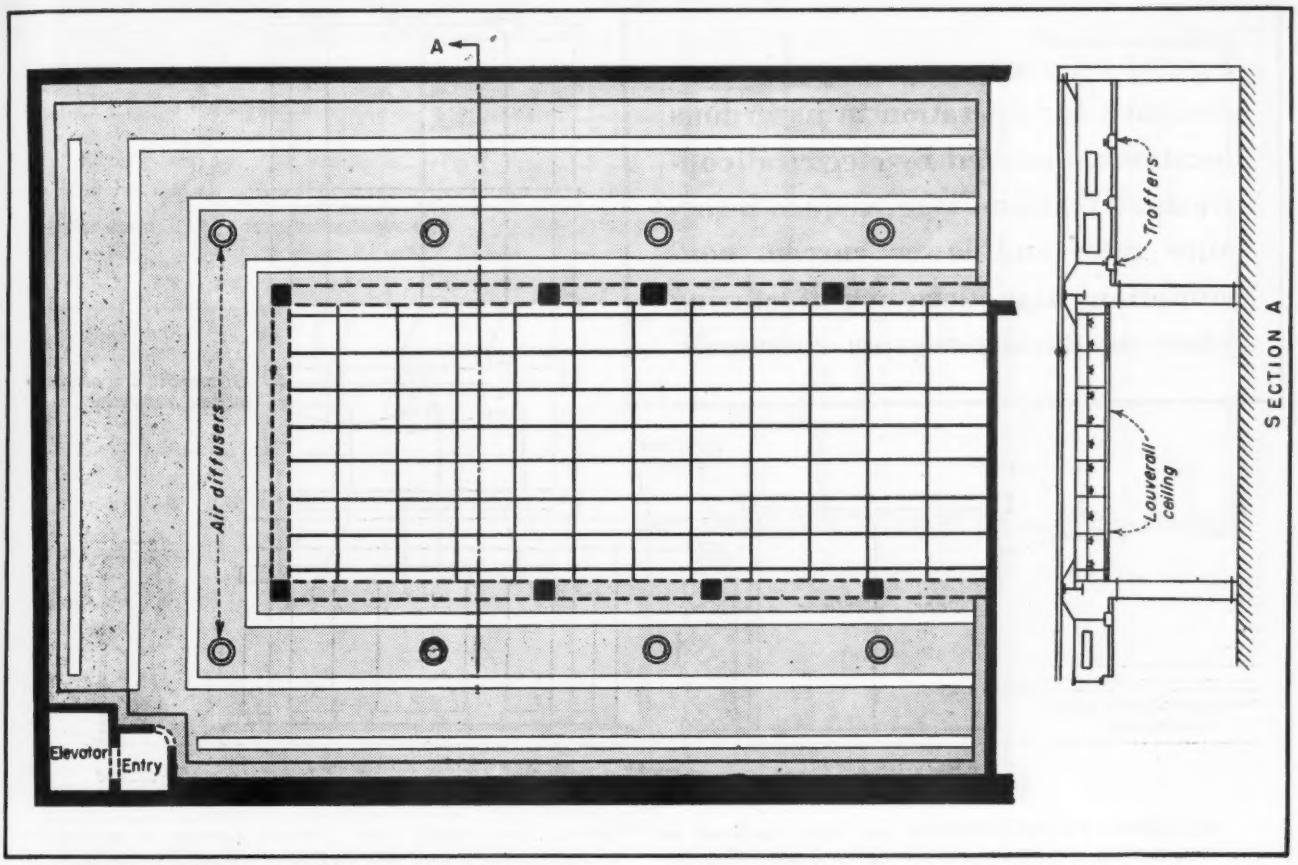
Louver Ceiling Relights Bank



ENTRANCE LOBBY *to main banking room of Central Trust Co. employs plastic louver-all lighting system.*



OFFICERS AREA LIGHTING *consists of continous row recessed troffers with glass covers, spaced on five-foot centers, to provide 60 footcandles of illumination.*



PLANNED LIGHTING LAYOUT *combines recessed two-lamp troffers with Albalite glass panels, and plastic louvers in louverall ceiling. Layout is simple in design, and provides cheerful, pleasing lighting results.*

T. H. Green Electric Company relights Rochester bank with Gold Seal winning modern louverall and troffer lighting system.

By Walter N. Parkes* and R. Bruce Thompson*

EVERY now and then a new lighting problem becomes a real challenge. Such was the case with the Clinton branch bank of the Central Trust Company, Rochester, N. Y. The problem here was to provide adequate lighting for the main banking room and entrance, to keep the lighting system simple in design, and to make it the nucleus of a friendly and inviting atmosphere. The challenge was not only one of design and layout, but also one of sales, and carried with it an obligation to develop a lighting result of which the customer might well be proud.

This bank was a portion of a complete office building, which was being remodelled throughout. The preliminary plans called for a ceiling height of 10 ft. 7 in. in the officers' and tellers' area, which formed a "U" pattern around the public or customer area. The finished ceiling height in the customer area was originally planned at 11 ft. 10 in., only 15 inches higher than over the work area.

The idea of this low ceiling in the main banking room was a radical departure from the usual 20-foot high and higher ceilings generally used in the past in such areas. The low ceiling normally called for a close spacing of lighting units of the usual type, if uniform lighting was to be had, which would have simulated a forest of fixtures, or a lighting fixture display room. Such a layout could not be tolerated from the viewpoint of creating a pleasing decorative atmosphere. Structural details would not permit an efficient cove lighting system. Whatever was used must be simple in design, and blend into the modern treatment of the interior. It must also give an impression of spaciousness and airness, since the room was closed in on all sides. It should create a warm, cheerful and friendly atmosphere.

Needless to say, there were a number of people interested in the lighting of the bank, each with a different idea of how it should be done. To crystallize these ideas, a trip to General Electric's Nela Park Lighting Institute at Cleveland was arranged for the architect, for the owner's representative, and for the lighting specialist. This visit culminated in the decision that recessed troffers for the officers' and tellers' U-shaped work area, and a louverall ceiling lighting system in the customers' area would provide the most satisfactory functional lighting, and also create the desired decorative treatment and cheerful atmosphere.

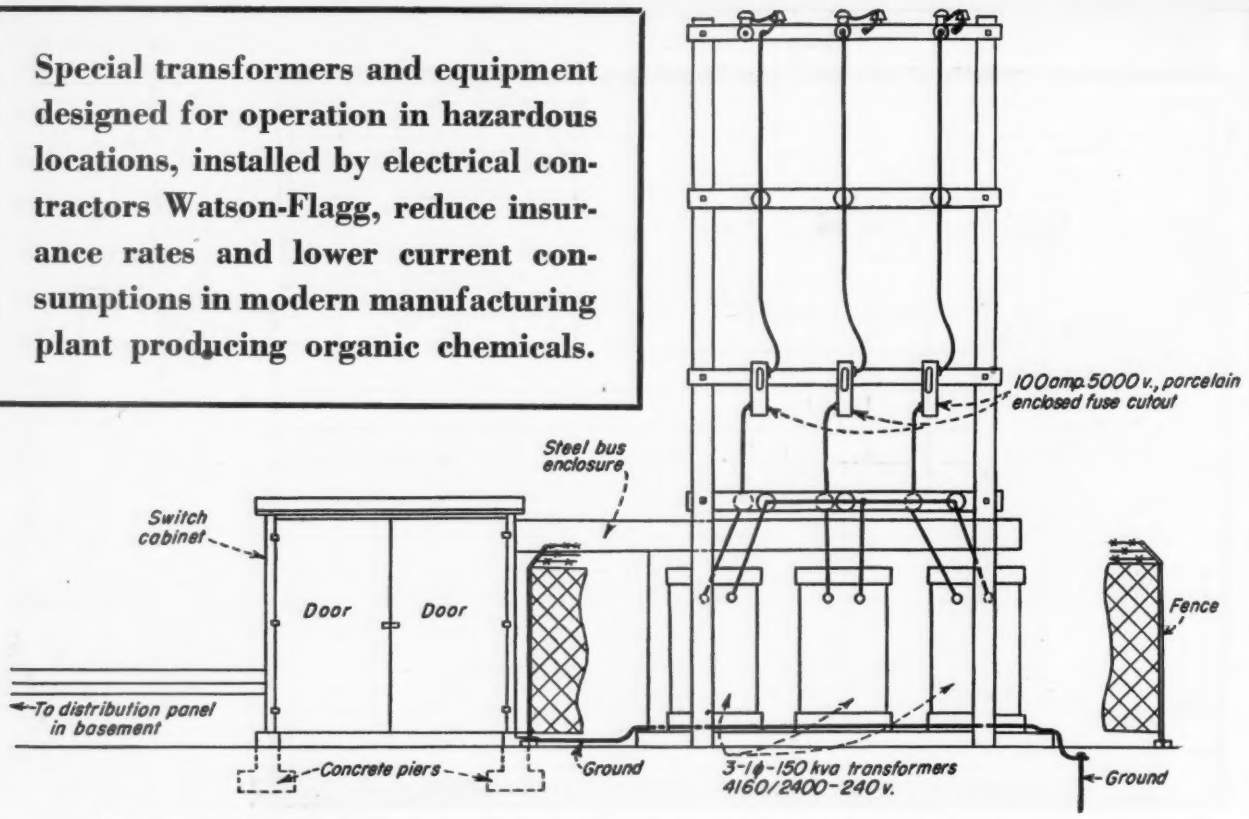
This visit also resulted in the de-

[Continued on page 110]

*Walter N. Parkes, lighting engineer, T. H. Green Electric Co., electrical contractors, Rochester, N. Y.

*R. Bruce Thompson, lighting specialist, formerly General Electric Supply Corporation, now Pittsburgh Reflector Co.

Special transformers and equipment designed for operation in hazardous locations, installed by electrical contractors Watson-Flagg, reduce insurance rates and lower current consumptions in modern manufacturing plant producing organic chemicals.



OUTDOOR TRANSFORMERS *are fence enclosed on concrete slab at base of primary terminal pole. Weatherproof busduct connects transformers with switching cabinet, from which point 240-volt current is carried by cable-conduit into new building erected by northern New Jersey chemical plant.*

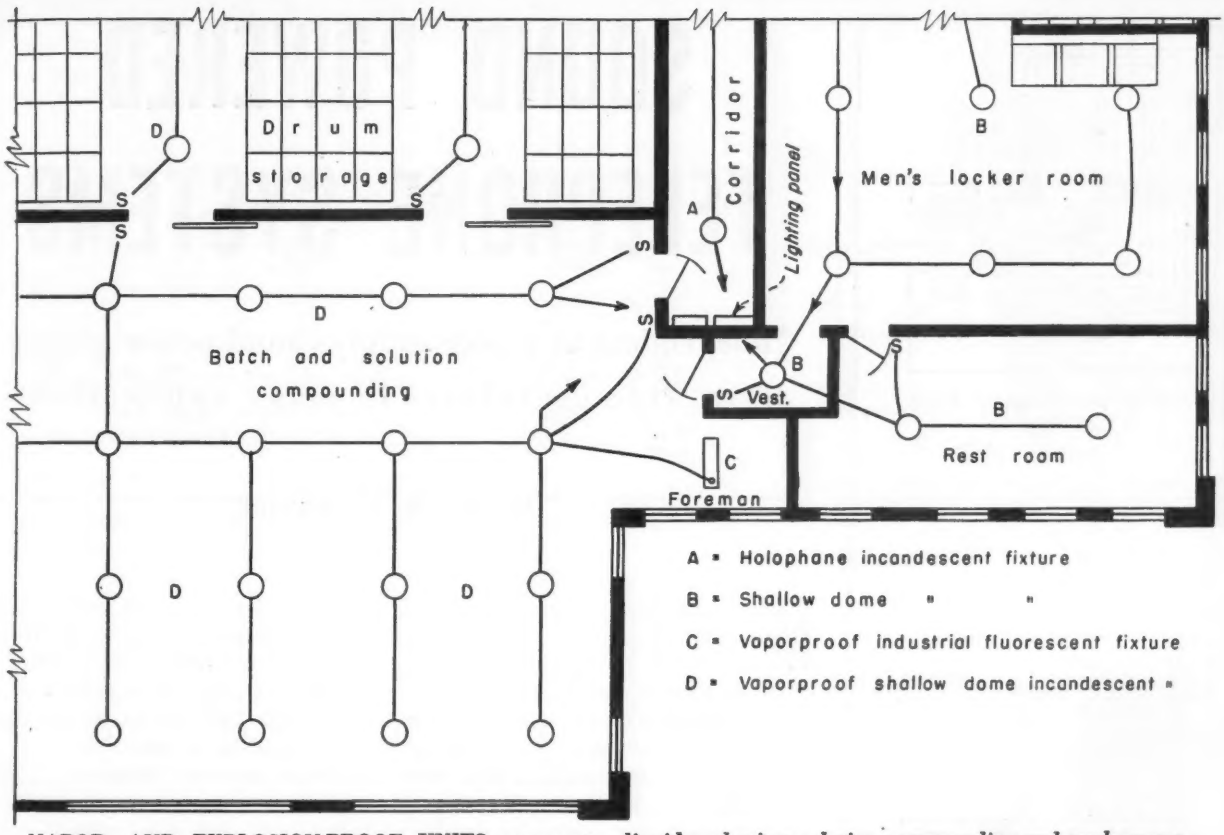
EXPLOSION-PROOF

EXTENSIVE economic studies played an important part in the selection of electrical equipment for the recently completed warehouse and shipping building of The Guardian Corporation at Delawanna, New Jersey. For, since the 72-structure plant is devoted to the manufacture of organic chemicals, long-range safety must definitely take precedence over initial installation costs. And, since the bulk of the power load is consumed by many small 220-volt motors, current characteristics and maintenance considerations are of prime importance. As a result of these economic studies, the installation frequently exceeds the specifications of the National Electrical Code and varies from normal substation practice. But safety and efficiency are the achieved results, with long-range economy proving the wisdom of this policy of preliminary surveys.

The first study was indicated while classifying the various compounding, packaging, storage and shipping areas. For several areas were technical borderline cases as to whether they were hazardous or non-hazardous, and other sections could legally be wired and lighted by either vapor-proof or explosion-proof equipment. In these cases where positive classification was doubtful, conferences were arranged with the insurance carriers for the plant and the stricter interpretation was consistently accepted. But, due to this super-safe attitude of The Guardian Corporation and their willingness to cooperate fully with insurance agents, annual insurance premiums were sufficiently lowered so that the higher electrical installation costs were neutralized by these reduced annual charges for protection.

A second economic study was made prior to the selection of transformer equipment, for there was a question as to what voltage would be best suited to the requirements of the building. With the power load consisting exclusively of lighting and many small capacity 220-volt motors, normal local practice dictated the selection of a secondary 208/120-volt distribution system. It was recognized, however, that operating these 220-volt motors at 208 volts would reduce motor efficiency and speed under full load conditions, would reduce starting and running torques as well as maximum overload capacities by as much as 10 percent, would increase slippage by about 12 percent, and would raise operating temperatures by several degrees.

These operating characteristics were weighed in the light of voltage drop, efficiency, current consumption, maintenance and estimated motor life, and the studies revealed that, since the bulk of the power requirement was for this motor load, long-range economic considerations would best be served by installing three 240-volt single-phase outdoor transformers at the secondary substation, with 3-phase, 4-wire dry-type 208/120-volt transformers located



VAPOR- AND EXPLOSION-PROOF UNITS *represent about 40 percent of the 120-kw. lighting load. They are located in areas devoted to drum storage, powder and liquid packaging, solution compounding and wash rooms. Wiring is also explosion-proof, with conduits sealed at switching and room entrance points.*

WIRING

By Ralph C. Hodges
Electrical Engineer
Wigton-Abbott Corporation
Plainfield, N. J.

adjacent to the main lighting panel for the illumination requirements. This decision, resulting in maximum motor efficiency due to the utilization of rated motor-design voltage, met with the full approval of the district utility; the Public Service Electric and Gas Company. As in the case of the previously-mentioned survey, this study paid off in improved operating characteristics, and higher equipment charges were neutralized by slightly reduced power consumption and greater motor efficiency.

As now installed, primary cables are pole-borne from the existing 4160-volt substation to the new secondary substation serving this warehouse and shipping building; a distance of 340 feet. Primary service is 3-phase 3-wire 60-cycle, and standard utility construction is followed, using suspension type strain insulators on double arms, pin-type insulators rated at 30,000/50,000-volts, class 3 creosoted poles and prescribed guying. The three single-phase outdoor 4160/2400-240-volt transformers, previously referred to, are fence enclosed and mounted on a concrete slab at the base of the primary terminal pole. Separate units have capacities of 250-kva., with wye primary connections and delta secondaries. Weatherproof bus duct connects transformers with an adjacent switching cabinet, in which are located an 800-amp. 3-pole air circuit breaker and related equipment.

Throughout the plant, distribution lighting panels are of dead front circuit-breaker construction, with non-active circuits (such as blocks, receptacles and unit heaters) grouped at the bottoms of the panels, and up to three branch circuits—on different phases—using a common, plainly identified neutral. The main power and lighting panels, also dead front, combine the deion breaker principle, while secondary power panels have fusetron safety switches installed.

In industrial areas, both 120 and 220-volt receptacles are 2-wire 3-pole, with equipment ground pole grounded to the conduit system. Spring covers have been specified throughout, and arcless construction is also standardized.

In general, galvanized conduit is installed either in concrete slabs or run in the furred spaces above hung ceilings, and switches and receptacles are also concealed wherever feasible. Minimum wire size is 12 gage except for control circuits where the gage is 14. Types of wire include R and T generally, with RW or TW in damp locations such as ground floor slabs, RH for main service cables, and heat-resisting AF in all lighting troffers. Branch circuit splices are either soldered and tapped, or made with high-pressure crimped caps, while taps on the larger cables utilize mechanical clamps and lugs.

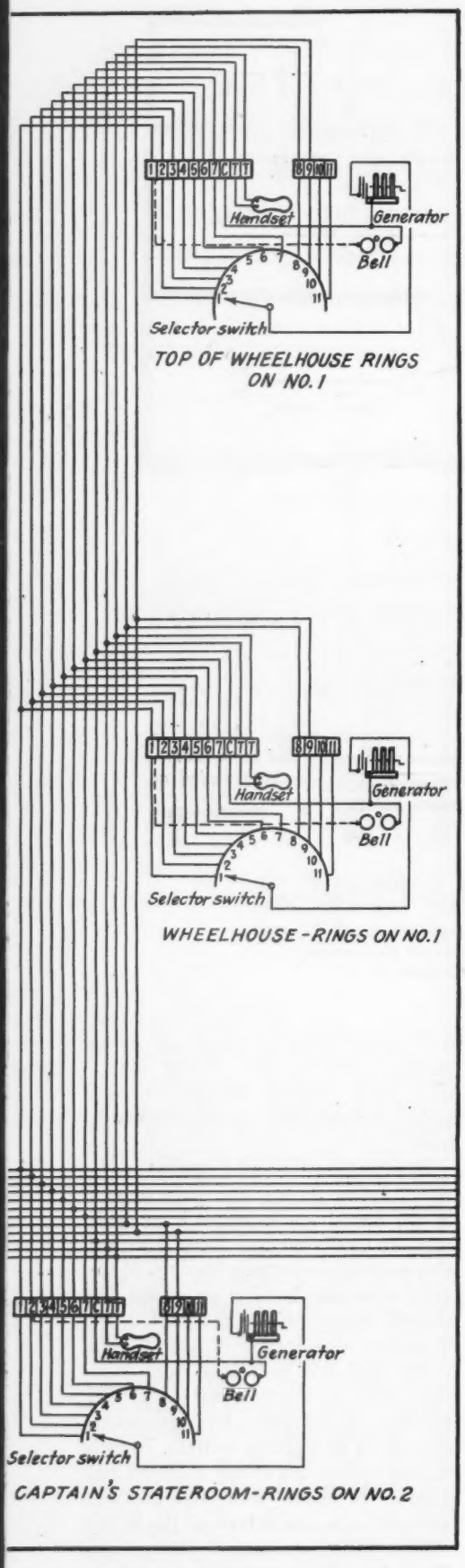
Vapor-proof and explosion-proof lighting represents about 40 percent of the entire lighting load, for roughly

(Continued on page 112)

SOUND POWERED TELEPHONE SYSTEMS

Independent of power supply sound power phones have wide usefulness in many applications.

By A. A. Schuhler


1 2 3 4 5 6 7 C T T
8 9 10 11
Handset
Generator
Bell
Selector switch
TOP OF WHEELHOUSE RINGS ON NO. 1
WHEELHOUSE - RINGS ON NO. 1
CAPTAIN'S STATEROOM - RINGS ON NO. 2

PARTIAL WIRING *diagram Hose McCann, selective ringing, common talking sound powered marine telephone system. (Fig. 1.)*

MUCH has been said about the various applications of sound powered telephones in important branches of the services and on ships during the recent World War II. However, the facts are that they were in reality developed before that conflict to a very high degree. Further progress was largely due to the successful development and improvement of magnetic materials and certain other alloys of different metals. The final result was high fidelity response, and excellent operation over a wide range of temperature, humidity and corrosive conditions.

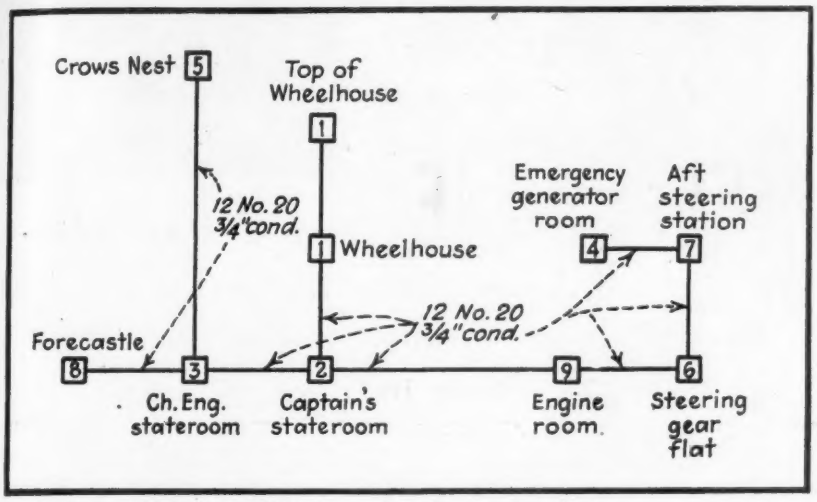
There is now a marked trend toward their use in large and small businesses, farms, homes, industrials, mines and other hazardous locations. These systems are inherently non-hazardous because it is impossible to produce a spark, receive an electric shock or cause the wiring to overheat. Several models have been tested and approved by the Bureau of Mines, U. S. Department of Commerce for use in mine atmospheres that may contain methane or coal dust. Because of the explosion-proof feature, these systems are of special interest to oil refineries, chemical plants, flour mills, gas works and other operations where explosion-proof gases and dust may be present.

Other models have been approved by the Merchant Marine Inspection Bureau, United States Coast Guard. These are constructed to strict marine standards, are watertight and splash-proof, are thoroughly insulated from ground, and the interior wiring is treated for protection against moisture.

Because of their independence from any outside source of power, service may be provided in remote areas and emergency applications such as in forestry, lumbering, oil well drilling, vaults, refrigerator plants, marine applications and many others where facilities for current supply are not convenient and where uninterrupted communication is essential.

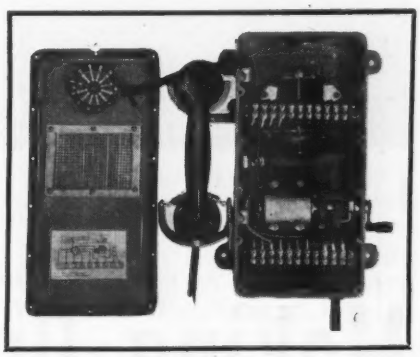
Sound powered telephone systems may be obtained for operation without batteries or any other outside source of power. This applies to the talking or speech transmission and to the ringing or calling signal. The instruments are definitely not designed to operate in conjunction with and must not be connected in the circuit of any telephone system using a supply of current. There are some known cases where such interconnection has been accomplished, but not until a special arrangement of condensers were placed in the sound powered circuit.

In operation they are in many respects similar to the conventional type of intercommunicating telephones. Instead of using a direct current from a battery or rectifier to supply energy for talking, the voice of the person using the instrument supplies the required power by setting up sound waves and concentrating them upon the transmitter. This action causes fluctuations in the magnetic circuit and creates a small electric current which cannot be measured with ordinary instruments. When this current is transmitted in this form over the line wires to the receiver at the called station, the action is repeated and becomes the sound waves which reproduces the speakers voice. Instead of using direct current from a battery or alternating current from a transformer for ringing, the power is supplied in either of two ways depending upon the type and application of the system, namely, by a permanent magnet magneto-generator



TYPICAL RISER DIAGRAM *Hose McCann selective ringing, common talking sound powered marine telephone system. (Fig. 2.)*

HOSE McCANN *telephone company sound powered marine telephone. (Fig. 3.)*



WHEELER SOUND *powered two station telephone. (Fig. 4.)*

or by a resonant generator ringer system. Where a magneto generator is used it is rotated clockwise by means of a crank. This action causes the commutator to move in a magnetic field of U shaped permanent magnets which in turn produces an electromotive force and generates current. In the resonant generator ringer system the magnetic action is essentially the same as for the talking system. However, in lieu of the diaphragms, the resonant system is comprised of a pushbutton or plunger operated weight tuned vibrating generator reed which is "plucked" by a ringing lever pawl and a mechanically biased vibrating ringer reed. This reed is responsive to the voltage changes in the ringer coil as transmitted electrically from the generator.

Sound powered telephones may be operated with audible signals requiring current. Some systems which ordinarily require a magneto-generator may instead be furnished with a transformer for ringing. Others may use a small battery, such as two flashlight cells connected in series. These actuate an interrupter within the housing of the telephone and this device in turn causes the transmitter and receiver elements in the handset to set up a vibratory signal. This signal is transmitted to the called telephone.

The calling signals may be in the form of (1) magneto howler, polarized bell or a neon glow-lamp if a magneto-generator supplies current, (2) mechanically biased vibrating ringer reed or a neon glow-lamp if the resonant generator is used, (3) interrupter combined with the transmitter and receiver if flashlight cells are used, (4) standard vibrating bells if a transformer is used. Where louder signals are required, the coils of a relay may be connected to the ringer terminals in the telephone, and the relay contact springs may be connected in series with the bell or horn and the source of current of the desired voltage. This may be accomplished in systems using the magneto-generator or transformer as the ringing power supply. The systems using a battery or transformer for ringing are not desirable for use in hazardous locations.

The talking circuit consists of handsets equipped with sound powered transmitters and receivers. These are connected in multiple and are essentially alike, are interchangeable and in general are composed of two Alnico magnets with cores of magnetically soft material. An armature is free to vibrate in the air gap between the pole pieces, and is connected rigidly to a metal diaphragm. The armature is further surrounded by a coil which connects to the terminal posts. In most cases a press-to-talk button is provided except where a hook-switch is used to make and break the circuit, or when used in certain forms of watertight and splashproof instruments.

The types of systems and their application are as follows:

1. *Two station or pair phone system.* Operation between two telephones only. Either station may signal or converse with the other.

2. *Common ringing, common talking system.* Operation between all telephones in the systetm. Any station may signal or converse with all others simultaneously. Signals are coded to differentiate between persons called. Only one conversation or conference may be held at one time.

3. *Selective ringing, common talking master system.* Operation between a central telephone and all outlying telephones in the system. The central master station may selectively signal any outlying station. Any outlying station may signal the central master station. The master station may call any outlying station so that two or more outlying stations may converse simultaneously.

4. *Selective ringing, common talking multiple system.* Operation between all telephones in the system. Any station may selectively signal any other station in the system. Only one conversation or conference may be held at one time.

5. *Selective ringing, selective talking system.* Operation between all telephones in the system. Any station may selectively signal or selectively converse with any other station in the system. As many conversations as there are pairs of telephones may be held at one time. A conference feature may be added if desired.

6. *Manual switchboard system.* Operation between a central switchboard and all outlying telephones in the system. The switchboard may selectively

[Continued on Page 113]

1 COPPER IS CUT *on special steel coil table scribed in inches for various coil lengths. Wire is fed from reel through shear to adjustable "stop" bar. Shear handle is connected to a mechanical counter.*

Making Open-End Coils

By
August Eckel

How open-end coils are made in the well-organized coil department of Giles Armature and Electric Works, Inc. of Marion, Illinois. A picture-story of practical shop ideas.

2 LOOP IS FORMED *in rectangular wire by edgewise bender designed and made in the Giles shop. Unit is on coil table; can make any size loop desired. Adjustable "stop" block on table can be set for any coil length; supports coil leg.*

3 INSULATION IS STRIPPED *off ends of coil loops by inserting them between revolving wire brushes. Both brushes rotate in same direction for flat copper; in opposite directions for round wire.*

4 LOOP ENDS ARE TINNED *in electric solder pot. Air nozzle blows off excess solder; does quicker and better job than buffing—where only one end at a time could be cleaned.*

5 KNUCKLE IS FORMED *on end of coil (five loops of copper) in special "knuckle cracker" plates mounted to vise jaws. One plate has coil rest, the other a spacing pin.*

6 COIL IS SHAPED *on special steel form that swivels on a pipe pedestal; can be tipped up or down. Eccentric "thumbs" and spacer blocks hold loops while coil is tapped.*

COIL production is an important phase of the motor repair operations of the Giles Armature and Electric Works, Inc., at Marion, Illinois, in the heart of the Illinois coal fields. The Giles shop keeps some 36 employees busy on repair work for more than 100 mines within a 50 mile radius; accommodates other shops by making coils on direct order; maintains a stock of several hundred sets of coils ready to repair more than 100 different types of motors in service in the area.

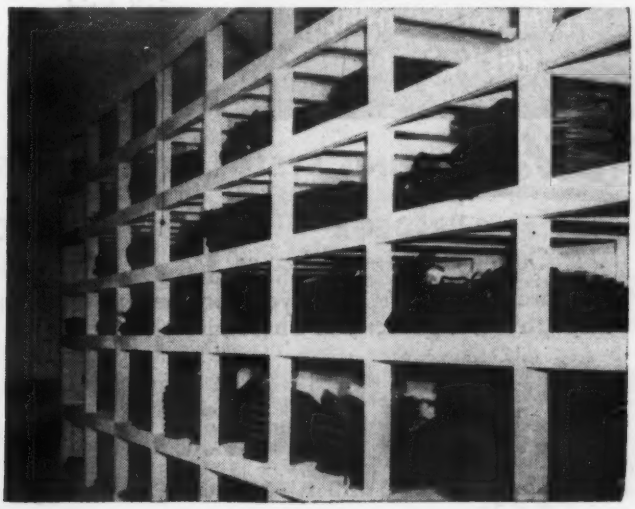
Service, quality workmanship and operating efficiency form the foundation upon which brothers William S. and John E. Giles have built their business. Modern equipment, ingenious shop techniques and a flare for organization are evident throughout the shop and specifically in the coil department—the heart of the Giles, or any electric motor repair, operation.

Typical of their coil department operation, is the production of open-end coils for mine motor armatures. The following photographs show the development of a coil from magnet wire reel to storage shelves; illustrate (with the exception of conventional taping, dipping and baking) the various shop techniques developed to meet the Giles standards of workmanship and efficiency.

Coils pictured are for locomotive armature.

7 COILS ARE PRESSED *after dip and bake to produce homogeneous insulation mass. Five seconds in hot press softens insulation, 30 to 60 seconds in cold press sets it. Pressed coils fit slots better; can have thicker insulation.*

8 COMPLETE COILS *are grouped in sets and stored in 48-bin rack for quick replacement in a burned-out motor. Inventory may include up to 8 sets of coils for each of 100 or more motors. Most of the coils are glass insulated.*



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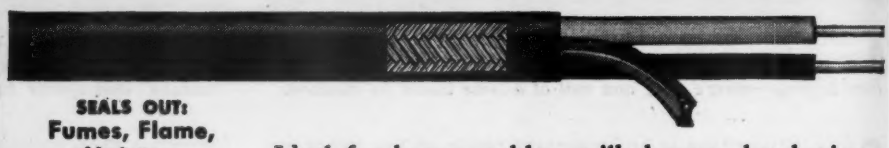
—SEVERE USAGE



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RESISTS:
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Ideal for barns, stables, milk houses, hatcheries, and other locations where moisture, ice, ammonia-laden air, rot, fungus and drastic weather changes are destructive to other approved types of wiring.

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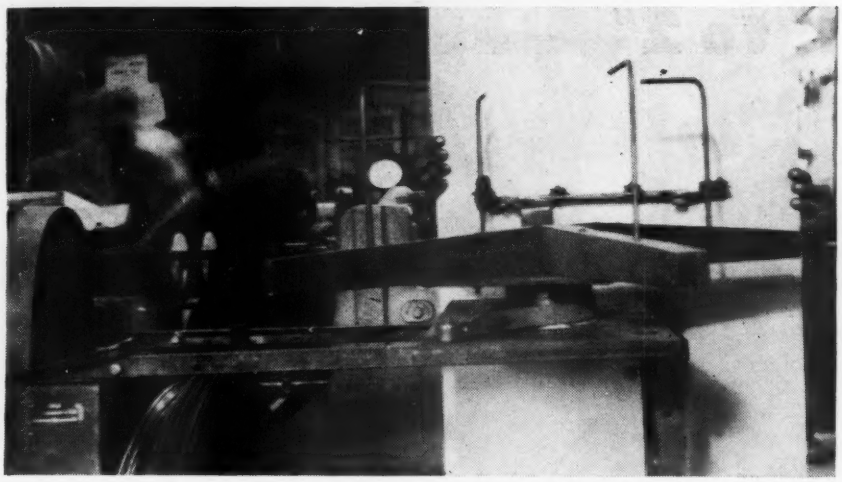
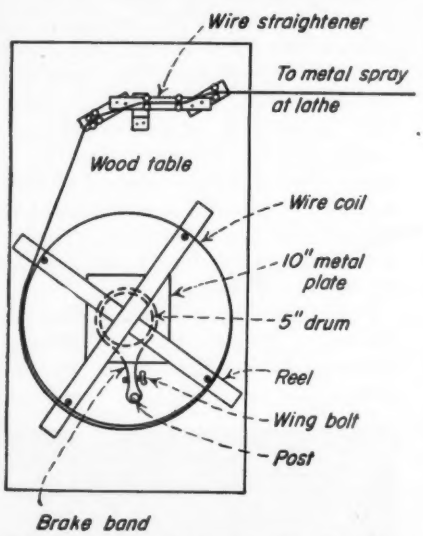
Motor Shops



Reel in horizontal, operating position. On the far side next to the screen is the wire straightener. Brake band shows in front.



Pay-off reel, designed by Vaughan Electric, has unique features.

Pay-off Reel for Metal Spray Wire

Vaughan Electric Service, Inc., Los Angeles designed and built this pay-off reel for metal-spray wire, embodying wire straightener and a unique tension control feature.

The equipment stands facing the lathe where the spraying is to be done. The flat top wooden table on which the reel is carried is fastened to a 1-in. angle-iron frame hinged at the left to the heavy frame of a coil winder convenient for the purpose but not a part of this equipment. The two legs supporting the outer end of the table are also hinged, so that the table and reel can be hoisted up to the vertical position out of the way when not in use.

On top of the table is a revolving metal drum 5 inches in diameter and on top of that a 10-inch square metal plate carying the wood reel. Pass-around this drum like a belt, and underneath the plate, is an endless copper band which also passes around a post mounted on the table. A wing bolt and nut near the post permits tightening the brake band so as to give desired tension on the wire as it comes off the reel.

On the opposite end of the table is mounted the wire straightener in which the wire passes through a series of twin, grooved wheels and comes out perfectly straight, which is necessary for use in the spraying equipment.

Lathe Jig Centers Sleeve Bearings

Sleeve bearings can be bored out on a lathe with considerable accuracy if the bearings are properly and carefully centered in the lathe chuck. This procedure takes a certain amount of set-up time and can add up to an impressive total in shops where many bearings are made of bronze stock or remade by re-babbitting.

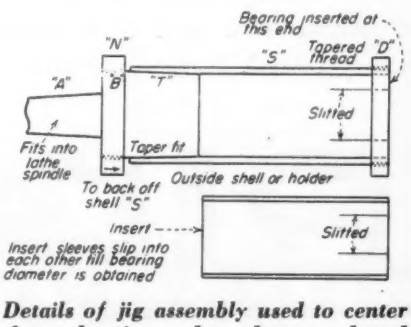
One method of minimizing this time has been developed by William Embree of the Arthur Wagner Company in Chicago. He designed a lathe jig that centers the bearing for the boring out operation. Entered in the 1948 NISA Awards Contest, this shop idea is published through the courtesy of the 1948 Awards Committee of the National Industrial Service Association.

The simplest way to describe the jig is to refer to the accompanying sketch. It consists of a steel section with shaft "A" accurately fitted to the taper of the lathe. This fits into the lathe spindle. Portion "B" is threaded to accommodate a large round nut "N". Extension "T" has a slight taper of $\frac{1}{16}$-inch in its 3-inch length. Shell "S" is accurately machined both inside and out and has an inside taper on the left end to match the taper on extension "T". The right end of this tube has a tapered thread for nut "D". Three or four slits at this end of the tube permits a slight contraction of the shell diameter when nut "D" is tightened. This securely holds the bearing which is inserted at this end.

When assembled, shell "S" is slipped over extension "T" and lightly tapped into place. The tapered joint assures accurate centering and a tight fit. The bearing is inserted in the tube from the right end with its collar against nut "D". Takeup of this nut grips the bearing securely. The boring tool is fed into the rotating bearing from this end.

To accommodate most of the standard motor bearing outside diameters, a number of tubular inserts (also split at one end) were made of $\frac{1}{8}$-inch and $\frac{3}{16}$-inch thick material. These sleeves fit between the shell "S" and the bearing that is to be bored. Nut "N" at the left end of the jig is used to back shell "S" off the tapered extension "T". This is sometimes necessary to remove tight fitting inserts in the tube.

The Wagner shop has two lathe jigs of this type. One has a size range from 1½-inch up to 3-inch and fits into a No. 5 tapered lathe head. The other,



Details of jig assembly used to center sleeve bearings when they are bored out on a lathe.

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with a size range from ¾-inch up to 1½-inch, fits into a No. 3 tapered lathe head. These accommodate bearings most frequently encountered in this shop. A large assortment of bearings are kept in the Wagner machine shop. About once a week 25 or 30 bearings are bored out and placed into stock for immediate use. The jig has proved a substantial time-saver for this weekly chore. It is not often used to bore out only one bearing.

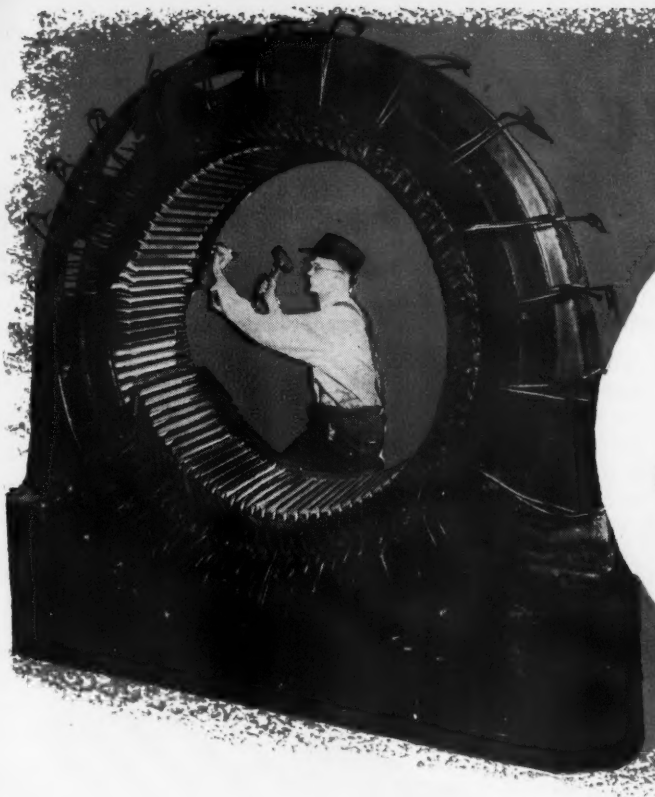
Electric Hoist Powers Elevator

An electric hoist, used to operate an inexpensive freight elevator, is responsible for making a balcony storage area readily accessible. Installed by the Moloney Electric Company, St. Louis, manufacturers of large transformers, this elevator lifts and lowers electrical components and parts to and from a mezzanine storage area.

The elevator is constructed of sheet metal sides and bottom, secured to channel-and-angle frames. It is guided vertically by upright angles extending from the ceiling of the balcony to the ground floor below the balcony. Lugs, welded to the elevator sides, keep it in correct vertical alignment. A fence-wire guard and iron-pipe gate surround the balcony-floor opening to provide the necessary safety. The iron-pipe gate is flattened at both ends. One end is pivoted to a guard rail post, and the other end fits into a clip-latch on the opposite post.

Power for lifting and lowering this elevator is furnished by a Yale hoist, permanently mounted to a building girder.

Yale Electric hoist is used to power this inexpensive freight lift between floor and balcony storage in the Moloney Electric Company plant, St. Louis. Limit switches automatically stop the elevator at the desired levels.



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The Braunlich-Roessle Co., Pittsburgh, Pa., serves a large industrial area, and their motor repair shop has enjoyed a fine reputation for competent work for 34 years. To Mr. Braunlich, a past president of National Industrial Service Association, *all* rewind jobs are *important*, whether large or small. They use Natvar Slot Cell Insulation, and other Natvar insulations, because they know they can depend on their uniformity and satisfactory performance in the completed job.

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are being specified more and more for plant and shop wiring, instrument wiring, underground primaries and secondaries, transformer leads, pole line risers, signal and control circuits.

SIMPLEX

WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

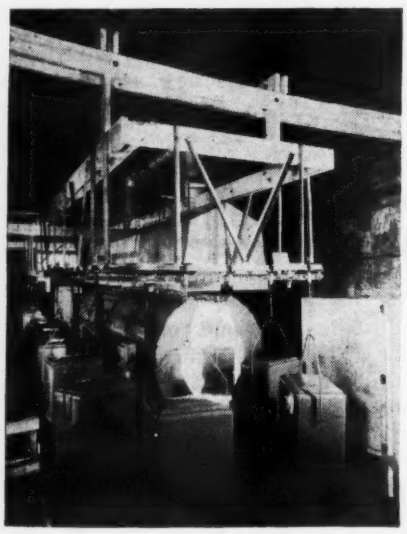
BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

Practical Methods

Infrared Finishing Speeds Production

INDUSTRIAL

Production has been speeded up in the portable refrigerator plant of the Louisville Tin and Stove Company, Louisville, Ky. This has been accomplished by literally "turning the heat on"; that is, on their picnic style ice refrigerators. This heat is turned on in a Fostoria Evenray infrared drying oven, used for drying the finish on the 18 in. by 18 in. by 13 in. refrigerators.

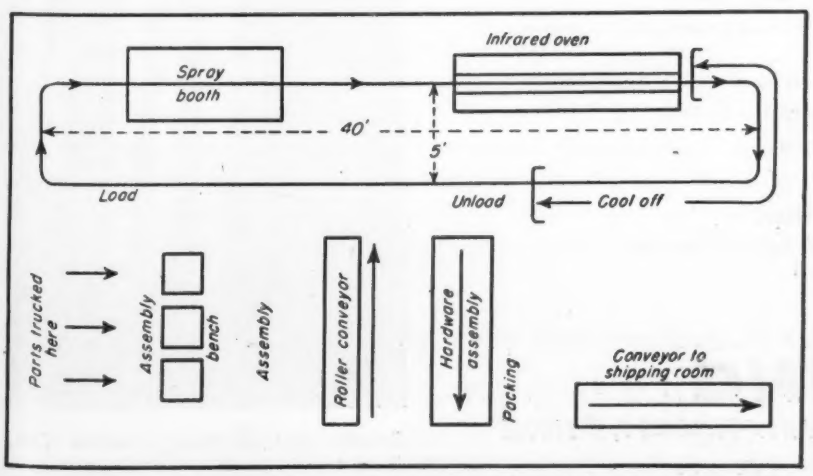


Portable refrigerators are bake-finished in five minutes with Fostoria infrared oven at Louisville Tin & Stove Co. plant, Louisville, Ky.

Intended for picnics, auto use, trailers, or any other need for a portable ice refrigerator, these picnic style coolers are finished with Dupont Dulux red synthetic. This finish is sprayed on the 18 gauge material, after which it is baked on in the oven for a period of five minutes. During this five-minute baking period a temperature of 350 degrees F. is reached.

A Keystone Junior monorail conveyor is used to convey the refrigerators, from loading area through the spray booth, through the infrared oven, and to the unloading area. The units are spaced three feet on centers on the conveyor, and are revolved during the bake period.

The infrared oven is made up of 40 sections of Fostoria Model No. 48-000 units, with ten gold-plated reflectors in cross section. A connected load of 43 kw. is used, made up with a combination of 250 watt and 375 watt clear infrared lamps. The gold-plated reflectors provide maximum efficiency, permit a minimum connected power load, and thus reduce operating costs.



Complete finishing system in portable refrigerator plant shown in outline.

Test Plugs On Moving Conveyor

WIRING

Electric ranges are scheduled to come off the assembly lines at the rate of 600,000 per year at Hotpoint's new conveyorized range plant in Cicero, Illinois. Every range gets a thorough electrical "operating" test before it leaves the final assembly line. Following automotive mass production techniques, this final checkup is made as the range slowly moves along on a slat-conveyor.

Test outlets move along with range on final assembly conveyor at Hotpoint's new range plant. Short test cord has three-prong plug on one end; three insulated spring-clip terminals at the other end for connection to range.

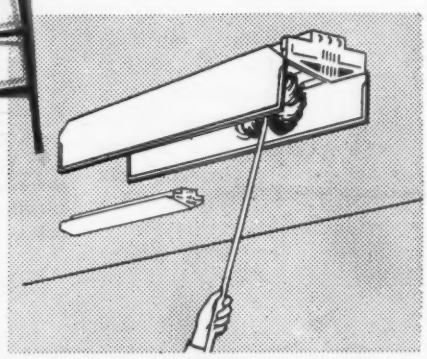
Facilities for this "on-the-run" testing are provided by numerous three-wire range outlets mounted flush in the conveyor slats, one outlet every seven slats. Short range cords, with a three-prong outlet on one end and three insulated spring-clip terminals on the other end, are used to connect the various ranges to the test outlets. After the test is completed, the operator merely disconnects the cord and uses it for another unit.

Electrical service to the outlets is provided by three bus bars installed under the "floor" of the endless slat conveyor. Three spring contact fingers, mounted to the under side of the test slat, ride the bus bars when the slats are "top-side". No contact is made as the slats return along the bottom of the conveyor, hence outlets are dead when in this inverted position. Each test outlet is individually fused (between contact fingers and outlet) so

NO MORE ACROBATICS!

...to enjoy unequalled glass-diffused lighting:

GUTH
"floating-hinge"
ARISTOLITES*



are cleaned right from the floor

Experts agree glass diffusion provides the finest reflected-glare-proof illumination, but costly cleaning was always a drawback... until GUTH pioneered the "floating-hinge" **ARISTOLITE.** Its glass panels swing open for economical *ladderless* dusting that makes its high efficiency easy to maintain.

Next time you want high intensities, better distribution, less glare and no shadows, use the unique "floating-hinge" **ARISTOLITE** ...the luminaire that makes better quality lighting *practical!*

- For full details of this years-ahead fixture, send for Bulletin 830-A from

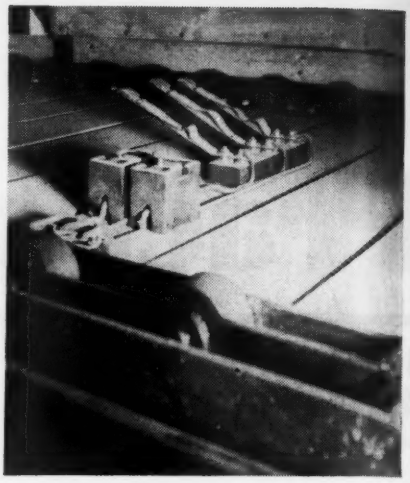
YOUR TEAMMATE IN *precision-planned* LIGHTING

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting Since 1902

876



Contact fingers feed outlets through fuse blocks. Contacts ride bus bars when slat is in "top-side" position. Here, test slat (underside view) is returning along bottom of endless slat-conveyor.

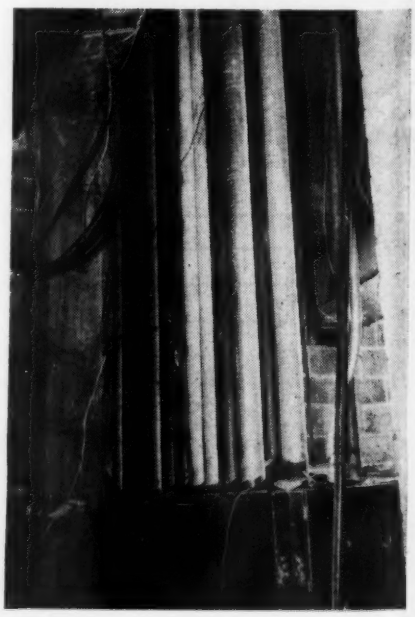
that any trouble that might develop will be localized and not travel back to the circuit protective device on the bus bar installation.

Installation was made by Sweningson and Company, Chicago electrical contractors on the new range plant project.

Pullbox Shifts Riser Alignment

WIRING

Installing multiple conduit risers in pipe shafts of multi-story buildings frequently poses a problem, particularly where the shaft is to enclose other utilities and air conditioning ducts as

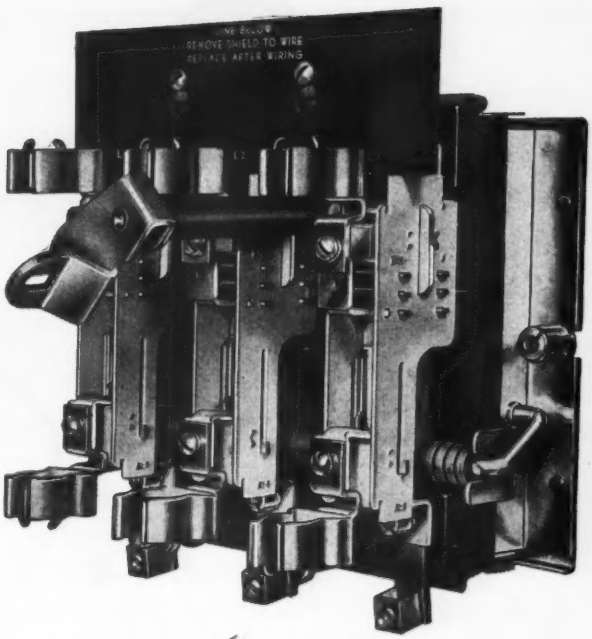


Double row of riser conduits (26) leave top of pull box and continue to eighth floor level.

NOW... an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

TRUMBULL'S HCI

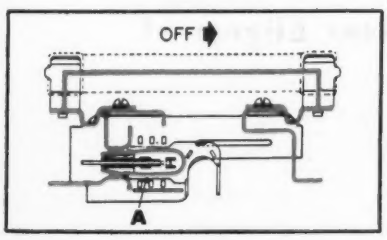
HIGH CAPACITY INTERRUPTER



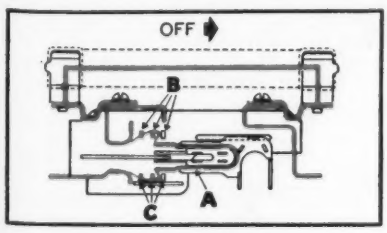
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.

Here's How...

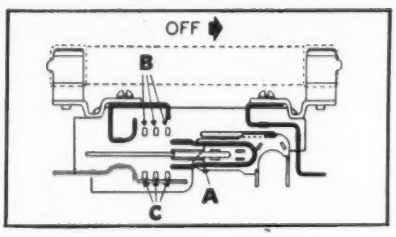
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Red indicates current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

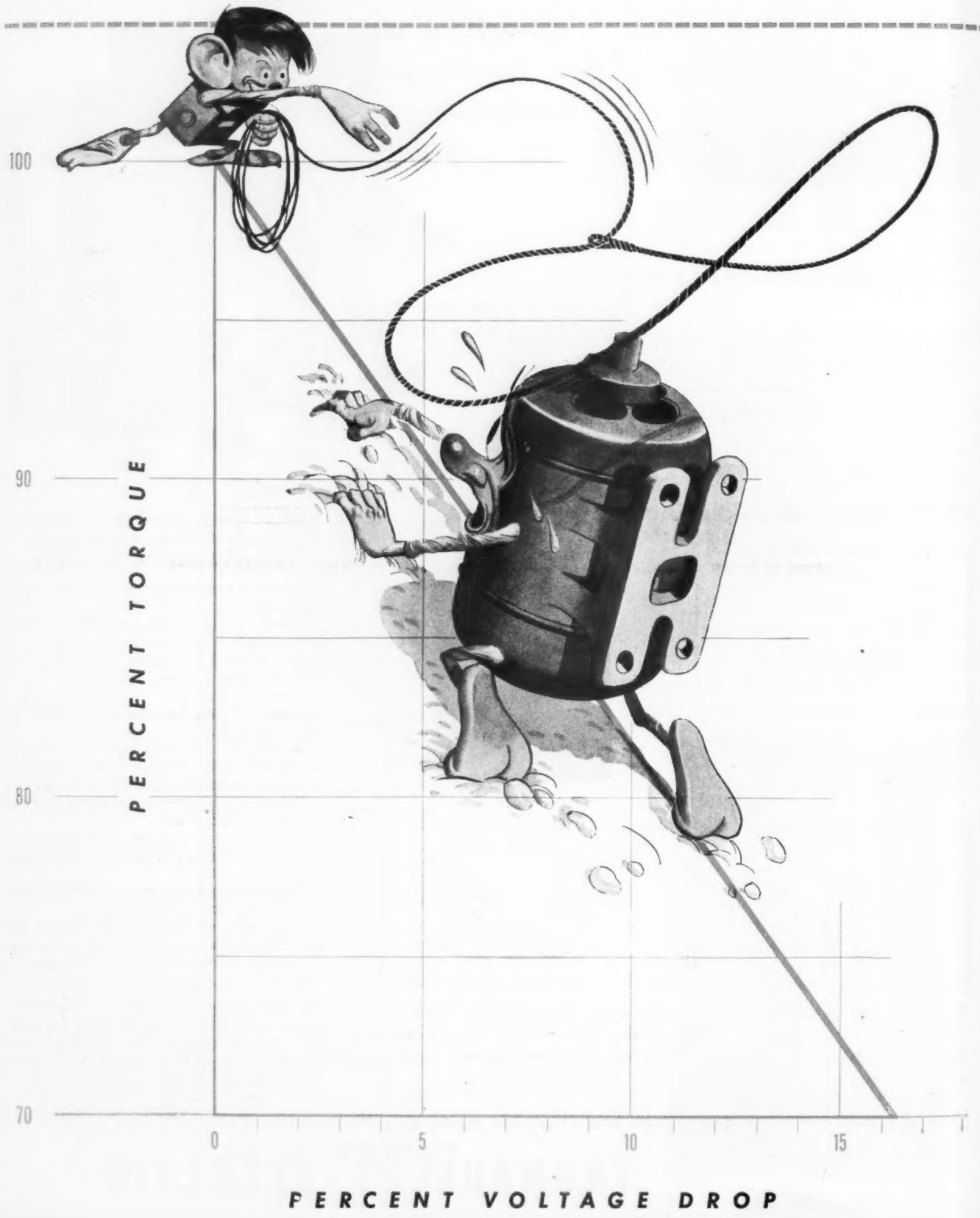
Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

YOU CAN BE SURE.. IF IT'S

Westinghouse



Apply the SURE CURE for Lagging Motors !

Motors start slow? Act sluggish?

When motors fail to live up to their rating, chances are the real trouble is undervoltage, the inevitable result of growing or changing loads that tax existing circuits. Correct this quickly, economically.

APPLY THE *SURE CURE:* Bring high-voltage power close to load centers with Westinghouse Dry-Type Transformers.

Overextended or overloaded lines cause voltage to drop. *A loss of only 12% of rated voltage reduces starting torque 23%, increases motor heating by almost 25%.* Lighting, heating and other electrical apparatus lose proportionately. But taking high-voltage power close to secondary loads reduces voltage drop and minimizes power losses.

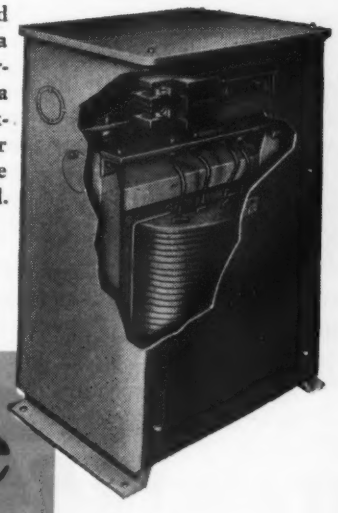
Because Westinghouse Dry-Type Transformers are smaller and lighter, they can be installed easily. There is no need for fireproof vaults—mount them overhead, on shelves, posts, or platforms. Welded sheet steel cases completely enclose the transformer for safety and a trim appearance.

You can be sure of effective correction of overloaded circuits with Westinghouse Dry-Type Transformers. For complete information, write for booklet B-4009. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-70533

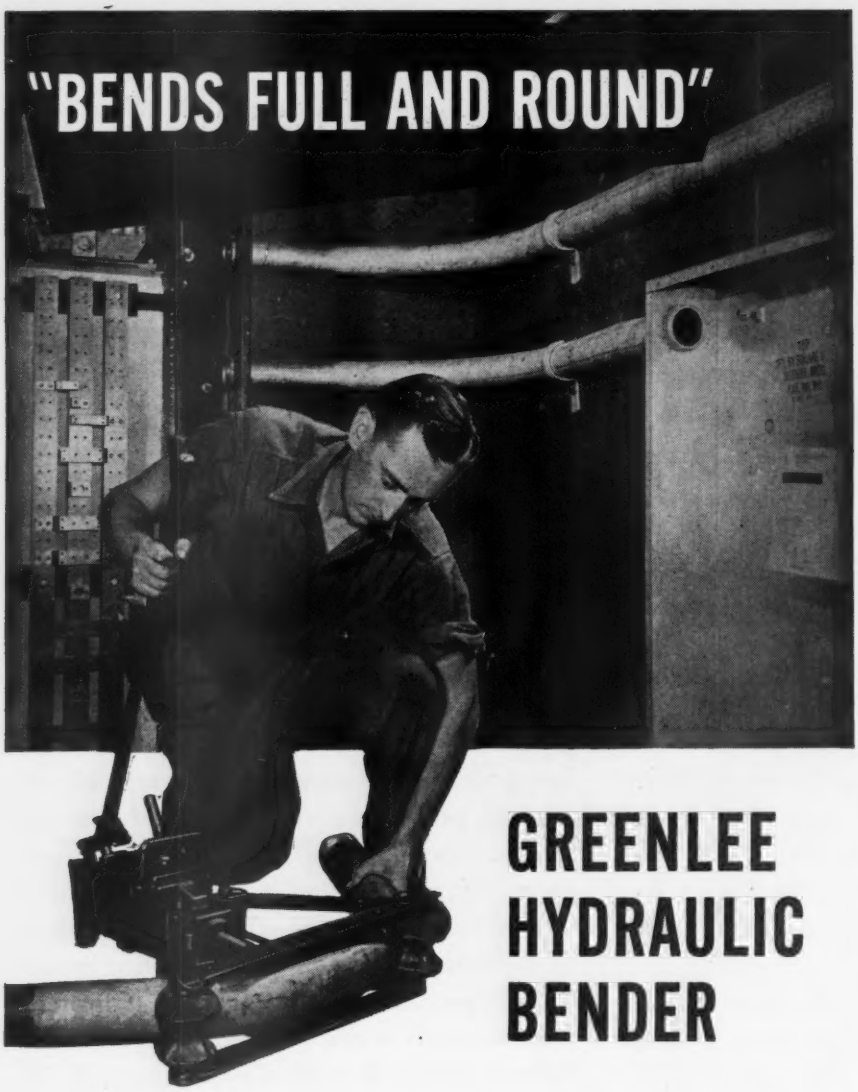
NOW AVAILABLE WITH BUILT-IN CIRCUIT BREAKER

New types AJRB and AVRB give you a transformer and circuit breaker in a single, compact package. The need for separate protective devices is eliminated.



Westinghouse

DRY TYPE TRANSFORMERS



GREENLEE HYDRAULIC BENDER

Yes, on your conduit installations you, too, will find that the GREENLEE "bends full and round, with no flatness or uneven spots on the elbow or curve," just as reported by Papentuss Electric Co., LaCrosse, Wisconsin.

"And," continues this company's statement about their GREENLEE shown above, "It has been in service nearly 11 years. On the very first job it repaid its cost and has since paid for itself many times over! Its adaptability to the different conduit sizes makes bending a simple operation and brings about substantial labor and money savings."

Investigate the GREENLEE today. See how you, too, can make big savings . . . do the job faster, better.

The GREENLEE Hydraulic Bender is one-man-operated. Makes precise, neat bends in just a few minutes—in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. It's compact, portable, easy to set up and operate.

Get all the facts on this timesaving equipment, write for your copy of new free Bender Booklet E-201. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1748 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK

Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

Cables shift alignment inside box from double-row on top to triple-row on bottom. Feeders continue down to main switchboard some 20 feet below.

well. Such a condition was encountered by Bertke Electric Company, Inc., Cincinnati electrical contractors on the new Terrace Plaza building in that city. Realignment of conduits was often necessary to conform to permissible clearances.

Bertke's solution to this condition was the design and installation of deep cable pull boxes that permitted easy shift from four and three-row groups to two-row alignment. Typical approach is illustrated in the accompanying photographs of a 26-conduit group riser from the main switchboard in the sub-basement to the 8th floor hotel elevation. The 26 3-in. and 3½-in. conduits turn up into the shaft and enter the bottom of a large deep pull box (about 20 feet above) in triple-row alignment. The same conduits leave the top of the box in a double row.

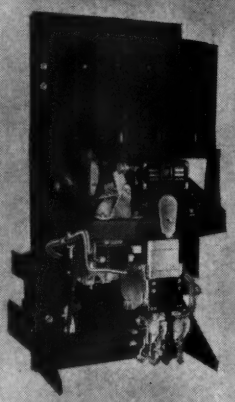
Design of a large enclosure facilitates cable pulling and permits easier fanning of the conductors when they shift alignment in the box.

Balanced Wave Welding Cuts Radio Interference

INDUSTRIAL

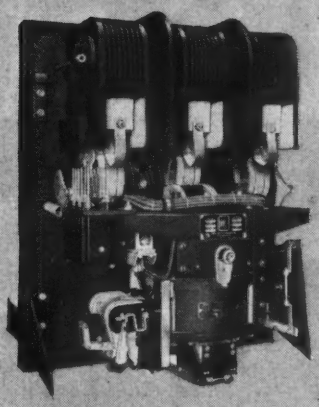
Welding equipment formerly used for inert gas shielded arc welding emitted a high frequency radio signal which was a constant source of annoyance to the radio listening public in the vicinity and to many commercial radio services as well. By using what General Electric engineers term a "bal-

The *extra quality* built into I-T-E Air Breakers



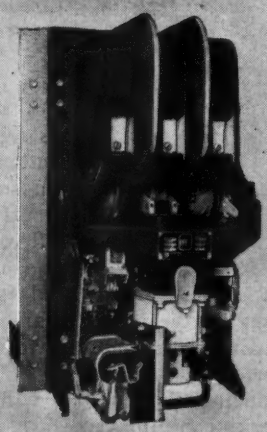
TYPE KA

15,000 RMS Amp. Interrupting Rating. 225 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or electrically operated.



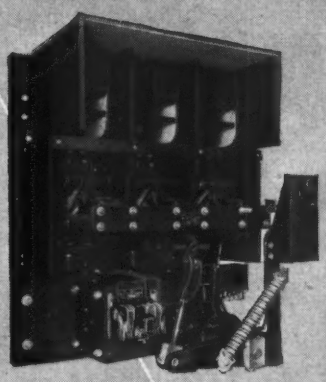
TYPE KC

50,000 RMS Amp. Interrupting Rating. 1600 Amp. Continuous Rating. 2 or 3 Poles. Manually or electrically operated.



TYPE KB

25,000 RMS Amp. Interrupting Rating. 600 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or electrically operated.



TYPE LG

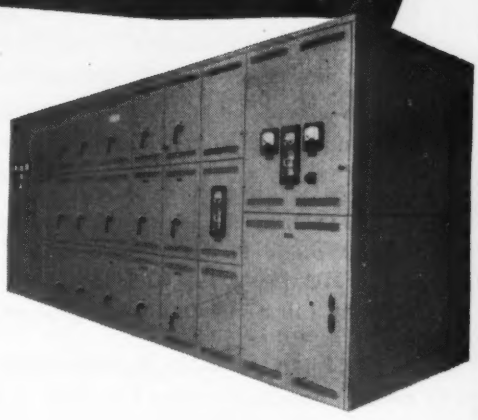
100,000 RMS Amp. Interrupting Rating. 6000 Amp. Continuous Rating. 2, 3, and 4 Poles. Electrically operated.

makes I-T-E Multumite your *best Switchgear buy!*

➡ These four circuit breakers were specially developed by I-T-E to protect feeder circuits and main circuits of medium capacity systems. They are typical of all I-T-E Air Circuit Breakers in that every one gives you important construction extras. Moving parts are heavier and stronger. Contacts combine speed with positive action. Arc chutes are designed and built better in every way for safer, quicker arc extinction. For any low-voltage application, the I-T-E construction extras — which you get without extra cost — make I-T-E Air Circuit Breakers unsurpassed for dependable performance . . . make I-T-E Multumite your best Switchgear buy!

COORDINATED IN MULTUMITE BOARDS

I-T-E Multumite Switchgear assemblies coordinate efficient I-T-E Air Circuit Breakers with transformers, meters, bus, and instruments into a single, highly effective unit of protection. And the planned provisions for proper relaying, interlocking, and tripping assure simple operations with complete safety to personnel and connected equipment.



ASK THE I-T-E REPRESENTATIVE *for complete information on low voltage I-T-E Air Circuit Breakers and Switchgear units. There is an I-T-E representative in your locality. All I-T-E Representatives are switchgear specialists—fully qualified to advise and assist you in planning or improving your distribution system. Use their services without obligation.*

I-T-E LOW VOLTAGE SWITCHGEAR

I-T-E CIRCUIT BREAKER COMPANY, 19th & HAMILTON STREETS, PHILADELPHIA 30, PA.

31 Offices in United States • In Canada, EASTERN POWER DEVICES, Ltd., TORONTO

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS

MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS

* *For power switching equipment refer to Railway & Industrial Engineering, an I-T-E organization.*

IRV-O-SLOT

The slot insulation *Bound* to last longer

Won't Migrate! Won't Delaminate!

The big news about Irv-O-Slot is good news for motor manufacturers. This famous slot insulation, with all its excellent electrical characteristics, benefits by a new, specially-developed Irvington binder that doesn't harden or lose its tack; that provides full assurance against migration . . . against delamination . . . against oozing out under heat. Thus Irv-O-Slot provides far greater service life, and far longer shelf life as well; and the thickness of the finished insulation is held within exact tolerance limits.

***Test Data:* The normal delamination test for slot insulation is 96 hours at 125°C. Laboratory tests show Irv-O-Slot withstands 150°C for over 288 hours, retaining full bond without migration.**

Irv-O-Slot is available in straight-cut or seamless bias varnished cambric bonded to either fish paper or rag stock. Write for generous test samples, further information.

"Look to Irvington **for Continued Leadership in Insulation"**

STANDARD OF THE WORLD
IRVINGTON INSULATION
TRADE MARK REG. U.S. PAT. OFF.

IRVINGTON

Varnish & Insulator Company

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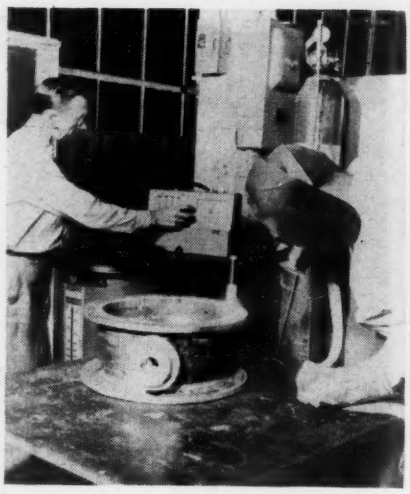


By using balanced wave system for eliminating continuous high frequency radio signals an aluminum casing is welded with G. E. inert-arc welder.

anced wave", combined with a new built-in control, this continuous signal is eliminated, reducing the duration of welder-caused radio noise to a small fraction of a second, an interval so short as to be comparable in effect on radio reception to the flicking of a home light switch. This balanced wave, representing five years of research, is used to maintain a constant welding arc in inert-arc welding.

By balancing the current with a bank of series capacitors, the balanced wave welder eliminates the continuous use of high frequency voltages so that pure a-c flows between the electrode and the work and, since the welding arc is stabilized without the use of radio-frequency energy, filtering or shielding becomes unnecessary. Welds are now cleaner, more easily controlled, and result is a 25 percent saving in used argon gas.

Simple rack for multiple conduit runs. Extra holes are drilled in plate for future conduits. Other plates can be added if necessary. Method was designed and applied by Robert B. Burton, electrical engineer of The Liquid Carbonic Corporation in Chicago.

HE'S UNDER IT-
HE'S OUT!

ALZAK

LOOK FOR THIS NAME

It identifies aluminum reflectors made extra bright that won't chip, spall, or peel. Clean them regularly and they will last indefinitely. Leading manufacturers make Alzak reflectors in standard shapes and sizes, in specular and diffuse finish.

Fifty-five feet above left field, this baseball's an easy mark for the fielder's eye. This unretouched picture was taken under actual night playing conditions. It proves the exceptional efficiency and lighting control possible with Alzak reflectors of Alcoa Aluminum.

Think of your own lighting. You sink a lot of money into wire, fixtures and current. It's uneconomical to install a poor reflector when Alzak reflectors can give you high lighting efficiency. ALUMINUM COMPANY OF AMERICA, 1946H Gulf Building, Pittsburgh 19, Pennsylvania.

ALZAK REFLECTORS
OF ALCOA ALUMINUM

ALCOA ALUMINUM

made® by Leading Lighting manufacturers

You know you're right with "G-E White"

Each step in the manufacture of General Electric White rigid conduit, from raw material to final inspection, is carefully controlled to bring you a uniform, high-quality product. Interior and exterior surfaces are smooth . . . threads are sharp and clean-cut. Finish is hot-dipped zinc, with an additional coating of baked-on Glyptal lacquer.

Always, when you think of conduit for protection from atmospheric corrosion, think of "G-E White." For further information, see your nearest General Electric Construction Materials distributor, or write to Section C14-818, Construction Materials Department, General Electric Company, Bridgeport 2, Connecticut.

*Trade-mark Reg. U. S. Pat. Off.

RACEWAYS ROUNDUP

with your

GENERAL ELECTRIC

Construction Materials Distributor

If you're wondering how to get raceway protection for wiring in cramped quarters, for machine tool or temporary wiring, General Electric flexible steel conduit is the answer. This conduit is strong, yet very flexible. It's quickly installed, and the zinc-coated strip steel is wound in a way that makes wire pulling easy.

Don't forget General Electric EMT for those light jobs that don't require the heavy-duty protection of rigid conduit. You'll like the way lightweight EMT can be easily handled . . . easily bent . . . quickly installed with threadless fittings. This thin-wall, welded steel tubing has an exterior surface of electrogalvanized zinc and an interior of corrosion-resisting enamel.

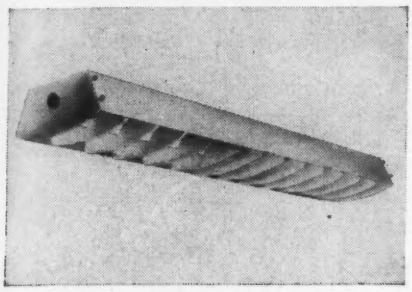
General Electric switch and outlet boxes are made in a variety of sizes, shapes, and depths for every purpose. The entire line of G-E boxes is available with galvanized finish. All cable and conduit boxes have improved knockouts, are easy to install, and have the approval of Underwriters' Laboratories, Inc.

On your next order, why not try the time-saving, "one-stop, one-package" service that your General Electric distributor can supply? Because he carries the complete General Electric line, you can order every item you need from him. No need to run around getting part of your requirements in one place and part in another. It's the kind of service busy contractors need to help stretch scarce working hours.

GENERAL ELECTRIC

Conduit Products

Equipment News



Lighting Fixture

A new fluorescent lighting fixture, known as "Varsity", has been announced. It is suitable for offices, stores and particularly schools. Fixture may be used as a single unit or in continuous runs. No connecting couplers needed for continuous row mounting. Baffle-type louvers offer shielding angles of 25°-27° and are removable for maintenance purposes. Unit uses two 40 watt lamps. Housing and channel are of steel. Wired units include UL and ETL approved sockets, type FS replaceable starters and UL approved H.P.F. ballast. *Leader Electric Company, 3500 N. Kedzie Avenue, Chicago 18, Ill.*

Staple

A new T-type staple, especially designed for use with the nex PVX or T-Type Cable has been announced. The new staple with inside dimensions of $\frac{1}{2}$ inch by $\frac{7}{8}$ inch, fits all types of nonmetallic sheathed cable — Romex, Braidex, PDX, Romeflex and others. Stiffness and rigidity make T-Type easier to drive. They come packed in bulk in cartons of 10,000 or in smaller boxes of 2,500, 500 or 100. *E. H. Titchener & Co., Binghamton, N. Y.*

Control System

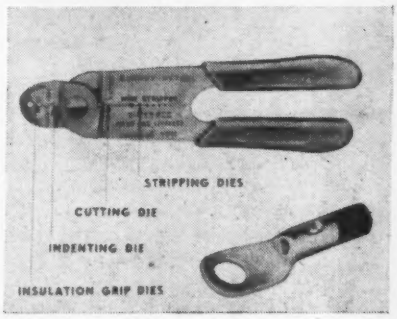
The new Magic Dial master control system is for heating, cooling and ventilating systems. Advantages are (1) a standardized control set-up, which can be specified by engineers and architects for any year 'round cooling, heating and ventilating system. (2) Faster, "mistake-proof" installation of controls. (3) A single master switch. System is controlled by one rotary switch in master control cabinet. Switch is turned to one of four positions: "Off", "Fan Only", "Cooling" and "Heating." Master cabinet has terminal blocks numbered to correspond with the numbers on each of the other 13 instruments in the system. Wires are also numbered. *Midwest Automatic Control Co., 510 Third St., Des Moines 9, Iowa.*

Regulator

A new pole-type voltage regulator, the JFR, which offers precise $\frac{5}{8}$% step voltage control to small sizes of feeder distribution lines has been announced. Unit has plus and minus 10% regulation and is completely self-contained with automatic control and line drop compensation. Its quick-break mechanism is built on the same principle of balanced spring design as AFR and DFR station-type regulators. The JFR is built for 10.8 kva., 7,200 volt, 15 amp. service. *Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

Circuit Protector

A circuit protector, the Pushmatic, featuring positive fingertip control and automatic protection for electrical circuits has been announced. A push of finger makes or breaks the circuit or restores the power flow when circuit has been broken by short or overload. It is an individual single pole unit. Available in four types, thermal only, thermal magnetic and both of these with ambient compensation, all of which are identical in size and contour, making them interchangeable for rating and type. *BullDog Electric Products Company, Roosevelt Park Annex, Detroit 32, Mich.*

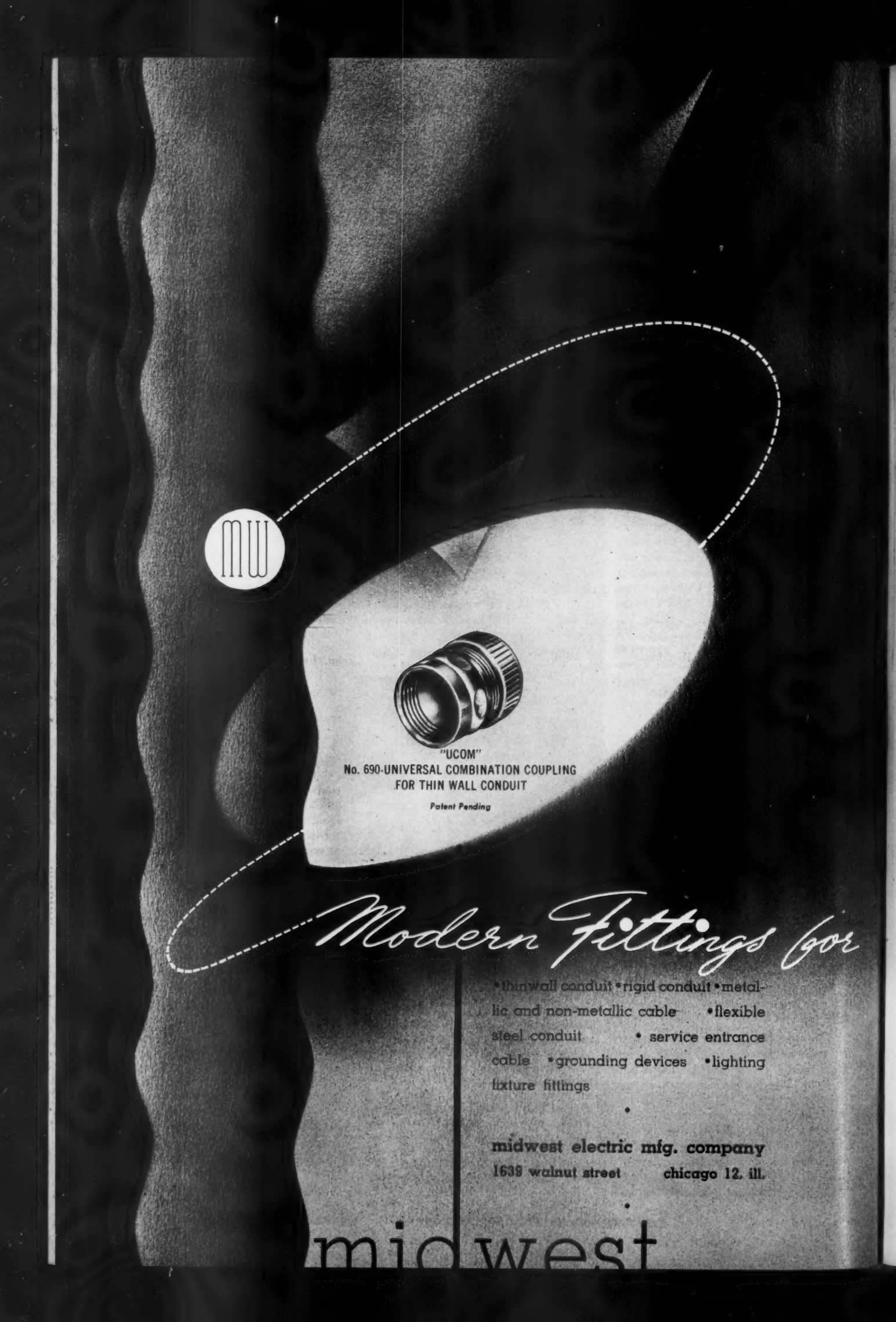


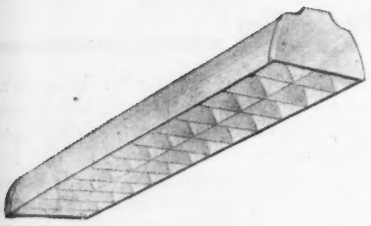
Tool

A new hand Hytool that cuts wire, strips the insulation, and indents Hydent connectors on wires No. 22 through No. 10 has been announced. It features a die groove which closes the insulation grips provided on many Hydent connectors. Handles of tool are long and of one-piece molded plastic. Made of case-hardened steel and provided with a black finish, it is resistant to corrosion. All die grooves are clearly indicated. *Burndy Engineering Company, Inc., 107 Bruckner Blvd., New York City 54, N. Y.*

Induction Motors

Type CS, totally-enclosed, fan-cooled, squirrel-cage motors with copper fins embedded in the stator laminations for additional cooling have been announced. Rapid conduction of heat from the stator is accomplished by interleaving circular copper punchings at intervals among the core laminations. Copper fins extend beyond the core iron so that heat picked up can be transferred to the external cooling air. Additional copper fins are fabricated with steel parts to form cylindrical heat exchangers at both ends of motor around the end turns. Motors are suitable for application in central stations, cement mills, flour mills, coal pulverizing plants, grain elevators, steel mills, and in other locations where atmosphere is contaminated with dust particles that are injurious to an open motor. Motors are not designed for outdoor locations where snow or other foreign materials may be encountered in such quantities as to obstruct ventilating openings. Available in large ratings up to approximately 1500 hp. at 1800 rpm, Class B insulation, 75 degrees C rise. *Westinghouse Electric Corporation, Pittsburgh, Pa.*


MW
"UCOM"
No. 690-UNIVERSAL COMBINATION COUPLING
FOR THIN WALL CONDUIT
Patent Pending
Modern Fittings for
•thinwall conduit •rigid conduit •metallic and non-metallic cable •flexible steel conduit • service entrance cable •grounding devices •lighting fixture fittings
midwest electric mfg. company
1639 walnut street chicago 12, ill.
midwest



Fluorescent Fixture

A new fluorescent lighting unit, known as "Challenger" has been designed for commercial lighting. Luminaires direct 40% of the light output upward, 60% downward. They are made of steel, finished high reflectance baked white enamel, and are designed for use with two T-12, 48 inch, 40 watt fluorescent lamps. Wired complete with high power factor two-lamp ballasts. Cat. No. 3525-CLH has 35° crosswise and 25° lengthwise shielding. Cat. No. 3545 has 35° crosswise and 45° lengthwise shielding. *Curtis Lighting, Inc., 6135 W. 65th Street, Chicago 38, Ill.*

Wire Stripper

TV-FM wire stripper for 300 ohm twin lead-in wire has been announced. Tool clamps the twin lead-in wire, cuts the insulation and strips both conductors in one operation. The lever prevents jamming of wires and strands. It also strips other popular electronic wires such as No. 16, 18, 20 and 22 without changing blades. One side of blades for twin lead, the other for single conductors. It is pocket size and weighs 13 ounces. *Holub Industries, Inc., Sycamore, Ill.*

Intercom System

A fully-selective, explosion-proof, electronic intercom system, suitable for plants where the atmosphere in work areas contains highly inflammable and explosive gases or vapors has been announced. System carries Underwriters' Laboratories approval for Class I, Group D hazardous areas, which include atmospheres containing gasoline, petroleum, naphtha, benzine, alcohols, acetone, benzol, lacquer, solvent vapors or natural gas. Stations in hazardous areas can call other stations in either hazardous or non-hazardous areas. Person called, whether in a hazardous or safe area, can answer from any reasonable distance without stopping work and without approaching station or using his hands to manipulate any switches. *Executone, Inc.*, 415 *Lexington Avenue, New York* 17, *N. Y.*

Panelette

A new "12 to 20 circuit" MO panelette with "plug-in" circuit breaker units has been announced. They are available in 12, 16 and 20 circuit combinations for either three or four wire service. Unit incorporates thermal-magnetic circuit breaker units that "plug-in" on cylindrical busbars and are interchangeable with those of the NMO panelboard. Panelettes were designed particularly for the type of wall construction in homes, schools, apartment houses, office buildings, industrial plants, etc. Boxes are only 12 inches wide and 4 inches deep, permitting surface or flush installation in shallow walls with studs on 16 inch centers. They are Underwriters' approved and labeled for "service entrance" applications. *Square D Company, 6060 Rivard Street, Detroit* 11, *Mich.*

Fluorescent Lamp Changer

A safety lamp changer which will remove and replace fluorescent tubes without the use of ladders has been introduced. The gripping jaws of the tool open by pulling a cord; when cord is released a spring automatically turns the lamp 90 degrees, when the lamp can be lowered. To install a new lamp, the pins in the lamp should be lined up with the slots in the sockets from where the operator stands on the floor. The lamp is then inserted in the socket, the cord is pulled until lamp is turned through 90 degrees, when jaws open and tool may be removed. *Newman Manufacturing Co., 205 Westport Road, Kansas City 2, Mo.*

Wound-Rotor Motor

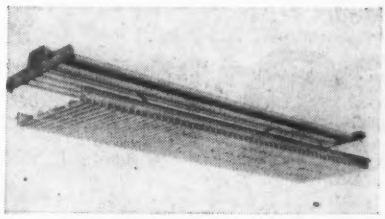
New Form BW protected-type wound-rotor motor, built in NEMA frames 224-505 in ratings up to 100 hp. and in larger frames up to 2000 hp. has been announced. Frames and end shields are dripproof. Motors are available splash-proof, and totally enclosed non-ventilated. Other mechanical modifications include NEMA floor-, sidewall- and ceiling-mounting assemblies, and NEMA C face and D flange mountings. Both C face and D flange motors are available for horizontal or vertical operation, with or without feet. They are designed for applications requiring smooth acceleration, high starting torque with low starting current, ability to start and stop or reverse frequently, or variable speed. *Crocker-Wheeler Electric Mfg Co., Ampere, N. J.*

Transformers

A new line of dry-type transformers with two rated-kva. 5% taps below rated primary voltage has been announced. Units will enable users to obtain 120/240 volts output from undervoltage supply lines. With ratings from 1-50 kva. inclusive, the new Type M and D transformers are designed for both 480 volt and 600 volt supply lines with series-multiple secondaries. They are particularly useful in lighting installations where some voltage adjustment may be necessary to maintain efficiency in light output. *General Electric Co., Schenectady* 5, *N. Y.*

Hand Torch

The new I.C.C. approved Torchmaster is a general utility, self-contained hand torch. It measures 2¼ in. by 13 in. and burns liquid petroleum gas. The torch will do light brazing, soldering, and innumerable heating operations. It burns upside down or at any angle and has a filtered "Wind-Pruf" burner that will not clog or blow out. It is of steel construction, and satin-chrome finish. A single control valve turns the torch on and off and adjusts the flame from a pencil point to a blowtorch. *Industrial Engineered Products Co., 7416 Melrose Avenue, Los Angeles* 46, *Calif.*

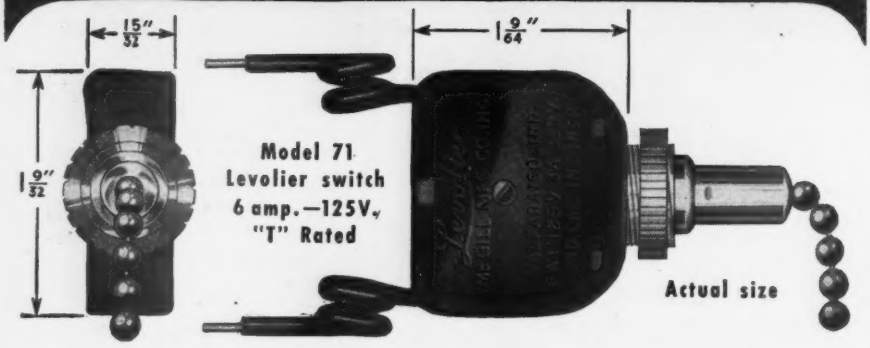


Lighting Fixture

The Director, a louvered fluorescent lighting "element" for 96 inch T-12 or T-8 instant-start slimline lamps has been announced. It is available for 2, 3, 4 or 6 eight-foot slimline lamps, and in matching units, for 2, 3, 4 and 6 40-watt T-2 fluorescent lamps, Louver, which provides a cutoff of 35° lengthwise, 25° crosswise, is partially released from one end for relamping and can be "shelf-suspended" from lever-hangers for electrical servicing. Installation can be surface or pendant. Adjustable clamp permits speedy surface mounting without the necessity of supporting the weight of the 8-foot unit while driving home toggle bolts. Continuous rows can be easily formed and wired. *Smithcraft Lighting Division, Chelsea* 50, *Mass.*

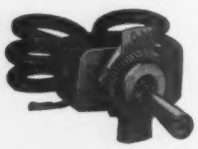
It's New!

the THINNEST 6 amp. "T" rated SWITCH and it's a *Levolier*

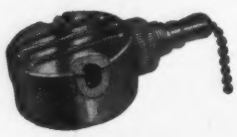


A LONG-LASTING, RELIABLE SWITCH FOR INSTALLATION WHERE SPACE IS LIMITED

Small, compact, streamlined lighting canopies and fixtures, and FHP motor housings have plenty of room for the new Model 71 Levolier switch. Less than 1/2" thick, the Model 71 fits in tight quarters. Yet it assures dependable, trouble-free switch performance. Precision built with a LEVOLIER type mechanism, it has 6" wire leads permanently fastened to terminals by pressure connections—no soldered connections. Insures easier and faster installation. Underwriters' Laboratories, Inc. has given the Model 71 a "T" rating, evidence of its ability to take an initial surge of eight times rated capacity. Model 71 Levolier switch has a durable moulded phenolic plastic case, patented lever control, pull chain, and six foot linen cord and bell. Consult your electrical wholesaler for full specifications of the Model 71.

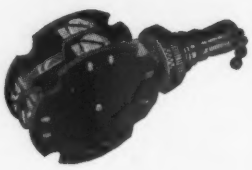


No. 25
6 amp. 125 Volt
Toggle Switch
Single Pole
"T" Rated



No. 1010
10 amp.
125 Volt
"T" Rated

No. 21
3 amp. 125 Volt
Pull Switch
Single Pole
"T" Rated



No. 265
6 amp 125 Volt
Double Pole
Double Throw

AVAILABLE FROM YOUR ELECTRICAL WHOLESALER

For Catalog 43 write: McGill Manufacturing Co. Inc., 450 N. Campbell Street, Valparaiso, Indiana.

McGILL
TRADE MARK
electrical specialties

ONLY McGILL MAKES *Levolier* SWITCHES

New Equipment Briefs

Lewis-Shepard Products, Inc., Watertown Mass. have announced a new general purpose **winch.** It can be used either indoors or outdoors. . . . The improved **wire connectors** in all sizes, manufactured by Holub Industries, Inc., Sycamore, Ill, carry Underwriters' Laboratories approval. . . . Electric Machinery Mfg. Company, Minneapolis, has announced a two pole boiler feedwater **pump motor** featuring pressure lubrication.

The Gould Storage Battery Corporation of Trenton, N. J. announces a new translucent plastic vent **plug,** named the "Televel", which tells at a glance whether the battery needs water. . . . A 45 kvar **capacitor** for high voltage, high frequency betatron generator application has been developed by Cornell-Dubilier Electric Corp. of South Plainfield, N. J. . . . A 3000 watt **incandescent lamp** for spotlighting stage shows has been developed by General Electric's Lamp Department, Cleveland, Ohio.

A new "Enpo" submersible utility **pump** has been designed to run under water and eliminate the possibility of pumps becoming inoperative due to flooding out. It is a ¼ hp., single phase, 115 volt, 60 cycle motor, and is manufactured by the Piqua Machine & Manufacturing Company in Piqua, Ohio. . . . A new **slot insulation,** known as Irv-O-Slot, has been introduced by the Irvington Varnish & Insulator Company, Irvington, N. J. . . . A new line of diagonal cutting **pliers** in 6 and 7 inch sizes are being manufactured by J. H. Williams & Co., Buffalo, N. Y.

A new line of insulating **current transformers** with stud-type primary and secondary terminals for aerial street lighting use has been announced by the Westinghouse Electric Corp., Pittsburgh, Pa. . . . The addition of an improved 8 inch **saw** to this line of Speedmatic tools has been announced by the Porter-Cable Machine Company of Syracuse, N. Y. . . . A new 5,000 watt a-c air-cooled diesel **electric plant** has been announced by D. W. Onan & Sons, Inc., Minneapolis, Minn.

The Square D Company, Detroit, Mich. has announced a new **magnetic polarity cap** for its voltage testers. . . . A new 6 inch home-utility **saw** has been added to this line of portable electric tools manufactured by the Black & Decker Mfg. Co., Towson, Md. . . . A new portable size d-c **kilovoltmeter,** with a double range of 0-15,000 and 0-30,000 volts d-c is now available from the Hickok Electrical Instrument Co.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has added a new 600 volt current **transformer,** Type KLW, to its line of instrument transformers. . . . A 100-ampere type GR rural-line **recloser** with interrupting capacity 1000 to 4,000 amperes for service on rural lines at 2,300 to 15,000 volts has been announced by Westinghouse Electric Corp., Pitts-

Your Central Conduit Distributor will do everything possible to meet your wants

CENTRAL SPANS CONDUIT

● Your Central Conduit Distributor has a modern efficient operation. But he hangs on to one old fashioned precept . . . *the customer is king.* He is always ready to go-the-limit when it comes to service.

If you need a few lengths or a carload of Central Rigid Steel Conduit, you'll find that he's ready to give you the kind of service that helps your jobs sail along smoothly.

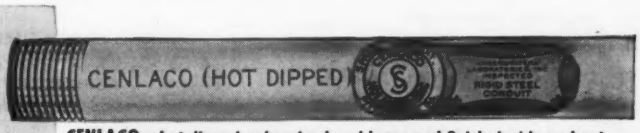
Next time you need conduit or other electrical supplies, contact your Central Rigid Steel Conduit Distributor first. He's a dependable source of supply and will do everything possible to supply *everything* you want—*when* you want it.

SPANG-CHALFANT

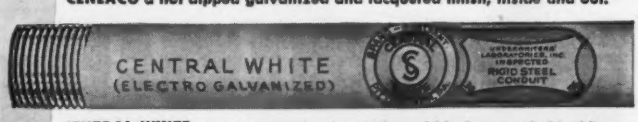
Division of The National Supply Company

General Sales Office: Grant Bldg., Pittsburgh, Pa.

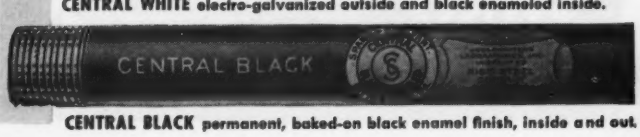
District Offices and Sales Representatives in Principal Cities



CENLACO a hot dipped galvanized and lacquered finish, inside and out.



CENTRAL WHITE electro-galvanized outside and black enameled inside.



CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

Designed for

RELIABILITY
PERFORMANCE
PROFIT

H&H { **FLUSH TUMBLER SWITCH**

"T" RATED—10 & 20 AMPERES FOR ALL STANDARD CONNECTIONS

These new back- or top-wired flush tumbler switches give you plenty of performance, profit and reliability. They install quickly and positively. There's no need to bend or loop wire — it goes straight into the unit from the back and is held firmly and permanently by a wire clamp. They're safer, too — there are no exposed wire ends. And they're ideal for use with heavier (10 to 14) wire. Top-wiring with conventional binding screws is optional.

FEATURES? HERE ARE A FEW

Double switch blades protected by 2 Bakelite barriers to snuff arcing • Self-aligning double switch blades give positive connection with solid, one-piece stationary contacts • Plenty of wiring room in the box • Switch mechanism is totally enclosed • One-piece base plate, with washer type plaster ears, is firmly locked into switch cover.

10 and 20 Ampere sizes are available with Brown or Ivorylite handles or as lock-type units; for 1- and 2-pole, 3- and 4-way, and single pole, quadruple break connections.

CALL YOUR NEARBY ELECTRICAL JOBBER FOR PROMPT SERVICE

WRITE TODAY FOR LITERATURE ON THESE AND OTHER H&H WIRING DEVICES.
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HART H&H HEGEMAN DIVISION

WIRING DEVICES **ENCLOSED SWITCHES**

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY
HARTFORD, CONNECTICUT

burgh, Pa. . . . The Frank N. Wood Co., Waukesha, Wis. has announced the addition of a **mica undercutter** attachment to its line of Trucut electrical repair equipment.

The Wiremold Company, Hartford, Conn., has announced the redesign of its 1914A **connector fitting** for entering the back of 1900 Plugmold multi-outlet system. . . . To its standard Type MT built-up **terminal block** Curtis Development and Manufacturing Company at Milwaukee, Wis., is now supplying vari-colored fiber marking tags in addition to the white tags for wire identification. . . . Vee Ply **belting**, designed to service emergency breakdowns, has been added to the V-Belt drive line of Worthington Pump and Machinery Corp., Harrison, N. J.

A new Autocon **alarm silencer**, type ABS, eliminating manually opened alarm circuits, has been announced by the Automtic Control Co. of St. Paul, Minn. . . . A new **abrasive** for cleaning and polishing metals has been announced by Ideal Industries, Inc., Sycamore, Ill. . . . Air Reduction Sales Company, New York, N. Y. has announced the availability of a new a-c transformer arc **welding machine**, known as the Wilson 200 ampere max. MCT.

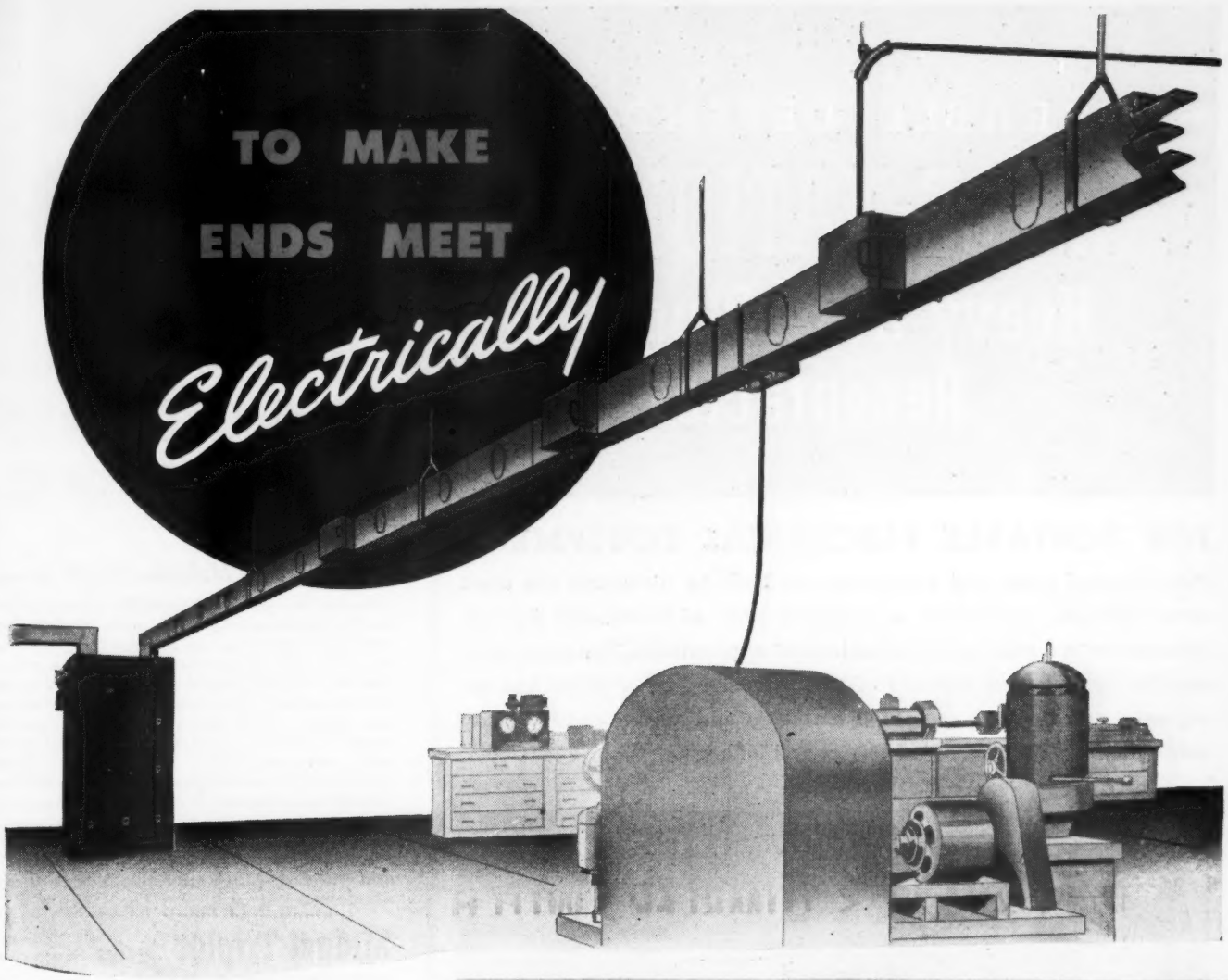
Radiart Corporation of Clevelard, Ohio, has announced the development of the Radiart Tele-Rotor, a **rotator** for television antenna installations. . . . Micro Switch, Freeport, Ill. has announced a new Micro-limit precision **limit switch** for use on all types of machinery and industrial equipment. . . . Designed for miniature lamp applications, a new line of miniature bayonet **sockets** has been added by the Frank W. Morse Company of Boston, Mass. to its line of Morse Eureka sockets.

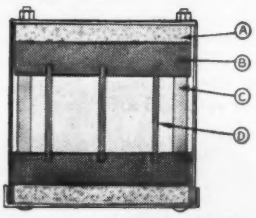
Vimco Mfg. Company, Inc., Buffalo, N. Y. has announced a new **socket clamp** designed to be used with all standard medium base sockets. . . . The international Rectifier Corporation, Los Angeles, Calif. has developed a new line of selenium dry-disc **rectifiers** for battery changing applications. . . . Slater Electric Company of Woodside, N. Y. has introduced the **Glo-Switch**, eliminating the necessity of a night light by casting a low, soft glow.

Security Mfg. & Contracting Company, Burlington, Wis. has announced the Green guard **lightning arrester**, to protect the home and farm buildings where electric storms prevail. . . . The Raytheon Manufacturing Company, Waltham, Mass. has placed on the market a new **fuse and resistor clip** with a unique locking feature. . . . The Arrow-Hart & Hegeman Electric Company of Hartford, Conn. has announced the adoption of **Plaskon Alkyd**, a new polyester type resin compound for use in molding bases and protective hoods for their line of "RA" magnetic starters.

Electric Motor Corporation, Racine, Wis. has added a new **motor**, Model 700, which can be series wound for exact power a product needs from 1/15 up to ½ hp. for continuous duty or ¾ hp. for intermittent use.

TO MAKE ENDS MEET *Electrically*





(A) Steel supporting channel; (B) Rugged porcelain insulators; (C) Fibre insulator spacers; (D) Copper bus bar conductors.

PLUGIN (FA) BUS BAR JOINT. All bus bars are hard drawn, round edge, rectangular copper of 98% conductivity. Joint contact surfaces are heavily ELECTRO-SILVER Plated. Brass jam bolts, with compression washers on each side, fit into elongated holes to permit contraction or expansion at *each joint.*

From power source to machine, the most economical electrical path is Plugin (FA) Busduct! It saves time! It saves money! It saves electricity!

Plugin (FA) Busduct provides a plugin outlet every foot of the way . . . permitting relocation and installation of machinery *quickly.* Mounted on ceilings, along walls, or even above baseboards, standard 10-foot lengths and special lengths can be arranged to fit any electrical requirement. Plugin (FA) Busduct *eliminates* costly temporary connections and expensive, long lead-ins . . . permits a *speedy* change in plant or electrical layout without disrupting production . . . and *reduces* voltage loss to a minimum.

Any way you look at it, Plugin (FA) Busduct makes ends meet . . . electrically, efficiently, and economically!

***Capacities:* 225 to 1000 amps., 600 volts, 2-3-4 conductors.**

Write for Bulletin No. 701 or see your nearest (FA) Representative (he's listed in Sweet's).

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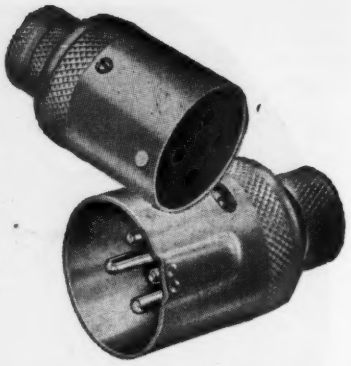
Makers of **BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER**

DURABLE • DEPENDABLE

PYLE-NATIONAL

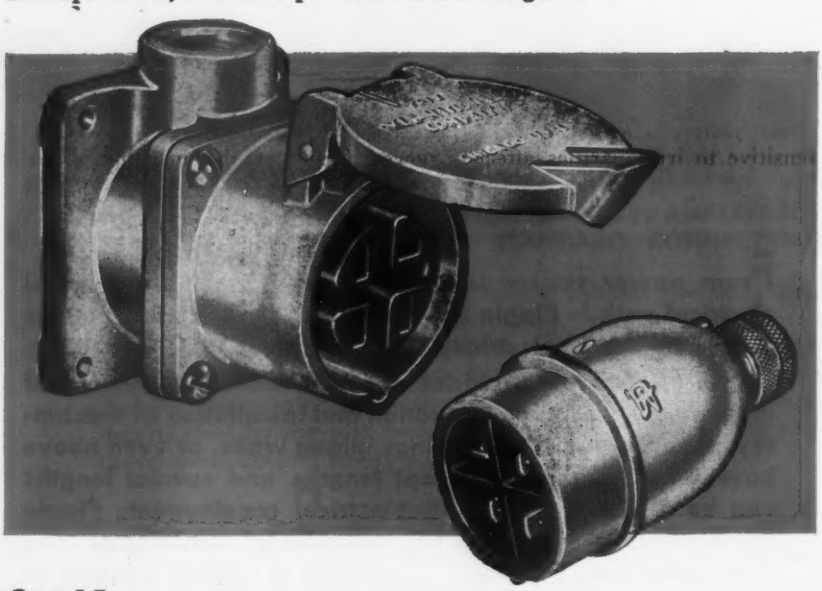
Heavy Duty Plugs and Receptacles



1, 2, 3, 4, 6, 8 pole interchangeable contact units

FOR PORTABLE ELECTRICAL EQUIPMENT

Pyle-National plugs and receptacles are built to withstand the most severe operating conditions, as proven by years of remarkably dependable service in a wide variety of industrial applications. The many substantial construction features of this extensive line of plugs and receptacles and the high quality of materials and workmanship insure safe operation, uninterrupted service and long life.



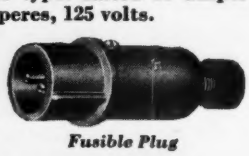
QuelArc • *Circuit Breaking Series* **Unique partitioned insulation provides long insulated paths through air and across surfaces for exceptional protection in these current rupturing devices. Galvanized cast metal housings, bakelite insulation and individually renewable contacts insure long service life. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts DC, 600 volts AC—2, 3, and 4 pole—grounded through shell or extra pole. Threaded cap, plain and hinged spring door housing styles are available.**

Triploc *and Multiple-Circuit Series*

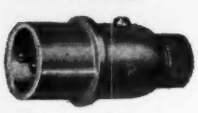
A line of exceptional versatility, unequalled in the heavy duty field, with a virtually unlimited number of assembly combinations for varied applications. Offers a selection of 1, 2, 3, 4, 6 and 8 pole contact units which are interchangeable and reversible in any single set of housings. Many types of single housings available of pressed steel with automatic lock and of cast metal threaded for watertight gasket seal. Multi-Circuit housings—2, 3 and 4 gang—available for combinations up to 32 poles. Ratings 15 and 20 amperes, 250 volts DC, 460 volts AC—circuit breaking. Pressed steel fusible and fuseless plugs measure 1 13/16″ outside diameter.

Midget Triploc *Series* **Same construction features as Triploc except for much smaller outside diameter of plug shell—only 1¼″. Interchangeable and reversible contact units—2, 3 and 4 pole—are of the flat blade type. Rated 10 amperes, 250 volts; 15 amperes, 125 volts.**

2-Gang Receptacle



Fusible Plug



Fuseless Plug

General Purpose *Series* **Available with cast metal housings in many types for circuit breaking and disconnect service. 30 amperes, 125 volts DC, 250 volt AC—1, 2, 3, 4, 5 and 6 pole. 60 amperes, 250 and 600 volts—3, 4 and 5 pole. 100 ampere, 250 and 600 volts—2, 3 and 4 pole. Also many special types, fusible and fuseless, for varied applications.**

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

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Testing Synchronous Converters

What a maintenance electrician should know about the design and operating peculiarities of synchronous converters; their trouble symptoms; also a suggested testing procedure.

By J. F. Baugh
Field Engineer
National Electrical Coil Company
Columbus, Ohio

THE synchronous converter is a hybrid, achieved by combining the windings and functions of an alternating current synchronous motor with those of a direct current generator for the purpose of converting alternating current to direct current.

The unit differs from the usual synchronous motor in the arrangement of the field and armature. The converter has a rotating armature and stationary field, whereas the synchronous motor is ordinarily constructed with a revolving field and stationary armature (stator). The field acts simultaneously as a synchronous motor field and a d-c generator field, since it is responsible for the magnetic flux through which the armature turns.

The armature winding, acting for both motor and generator, carries both alternating and direct current. The current of a single conductor in a motor winding flows in one direction, and the current of a single conductor in a generator flows in an opposite direction. When they are rotating in the same magnetic field, the resultant current in a single conductor of a conductor winding is equal to the difference between the alternating and direct currents. Therefore, the average net current in the winding is less than the alternating current of the motor or the direct current of the generator.

It is for this reason that a converter of a given capacity is smaller in size than a motor-generator set of the same capacity. While a gain is made in both cost and space required by using the converter, the machine is rather fixed in its operation, and is not as flexible as the motor-generator set. This does not mean that the converter is a delicate or a complicated machine in operation. On the contrary, it is a very rugged unit capable of carrying a very large overload and of taking a large amount of abuse. It does mean that, *for best operation, it requires a fairly constant a-c source of power and that it should not be used for correcting system power factor.* The converter is very sensitive to irregularities affecting commutation, but when conditions are as they should be, very large overloads may be carried without trouble. Some have been tested up to 400 percent load.

Synchronous converters may be either shunt or compound wound, and may have any even number of poles. The six-pole, six-phase machine is a very popular type, used extensively in current conversion in the coal mining industry. Some older design three-phase, six and eight pole, 60-cycle synchronous converters are used. The most popular capacity rating in mining service is the 200-kilowatt machine.

Converters are sold with special transformers with taps on the primary side, so that with variation in a-c supply the proper voltage on the rings of the machine may be secured. The relation between the a-c voltage and d-c output is shown in the accompanying table (Fig. 1.) With rated voltage on the rings, the converter field should be adjusted to give unity power factor at the machine when carrying 75% load; this will give approximately 25% lagging current at zero load. The compound winding of the machine will then build up the field with increased load, so that at full load the power factor is near 100% or slightly leading. With this setting, the shunt field current should never be changed. *Many operators make the mistake of trying to control d-c voltage with the shunt field.*

Trouble Symptoms

Most converter trouble, aside from neglect, is caused by operating with

TABLE OF VOLTAGE AND CURRENT RATIOS

TYPE	Voltage		Current	
	A-C	D-C	A-C	D-C
Single Phase	.707	1.0	1.5	1.0
Two Phase	.707	1.0	.75	1.0
Three Phase	.612	1.0	1.0	1.0
Six Phase (diametral)	.707	1.0	.5	1.0
Six Phase (double delta)	.612	1.0	.5	1.0

FIG. 1—Approximate relation between the a-c voltage and d-c output of a synchronous converter.

1 **1770**—Improvement of livestock by selective breeding boosted milk output . . . encouraged dairy farming. City folk now began to sample this wonderful beverage. But harmful bacteria in milk caused sickness, spread disease.

2 **1864**—France's Louis Pasteur won world acclaim by discovering how to rid milk of impurities. Milk soon became an important source of food. Vitally needed was electrical horsepower to speed it from farm to consumer.

3 **1915**—The year Howell Electric Motors arrived also marked the widespread use of the automatic rotary bottle filler and capper in the dairy industry. Soon, these rugged, industrial type motors were widely sought in many industries.

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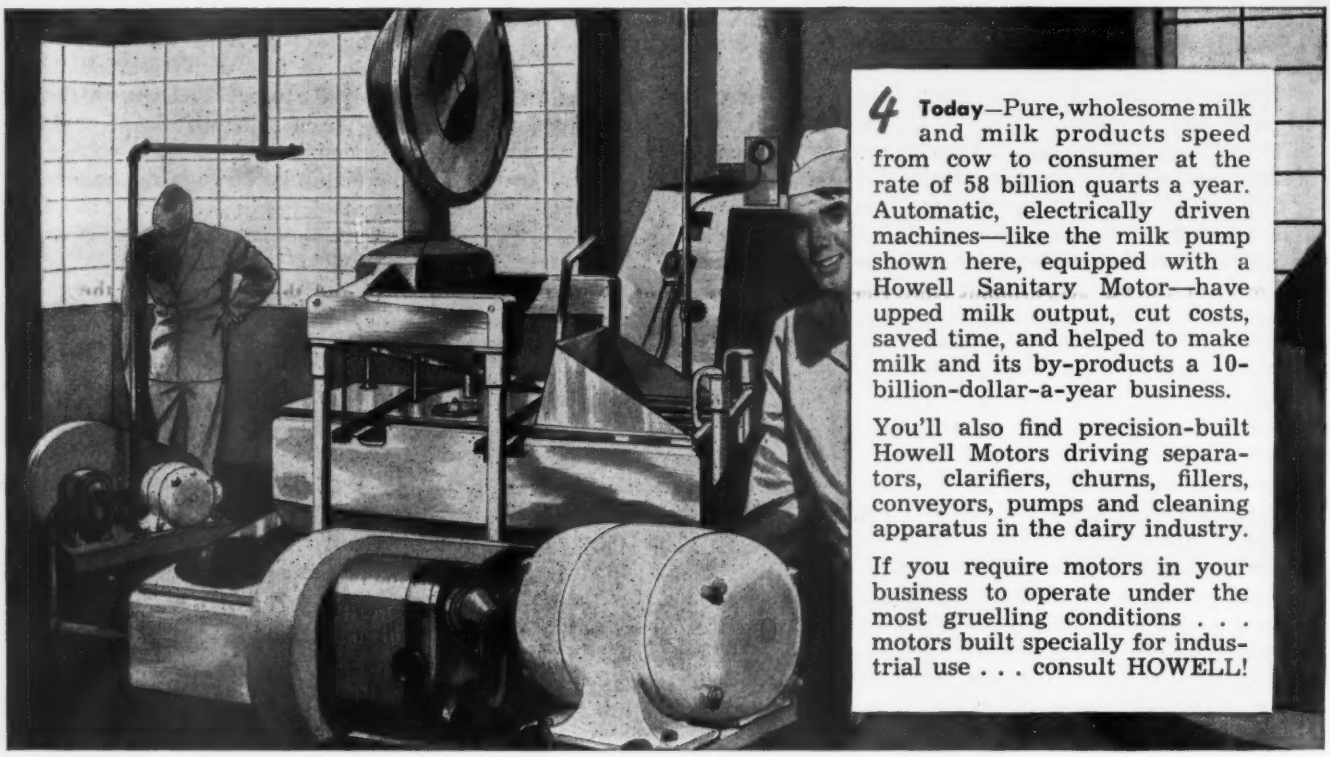

4 **Today**—Pure, wholesome milk and milk products speed from cow to consumer at the rate of 58 billion quarts a year. Automatic, electrically driven machines—like the milk pump shown here, equipped with a Howell Sanitary Motor—have upped milk output, cut costs, saved time, and helped to make milk and its by-products a 10-billion-dollar-a-year business.

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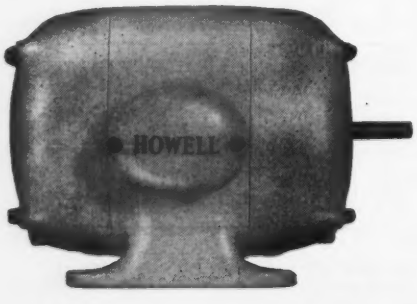

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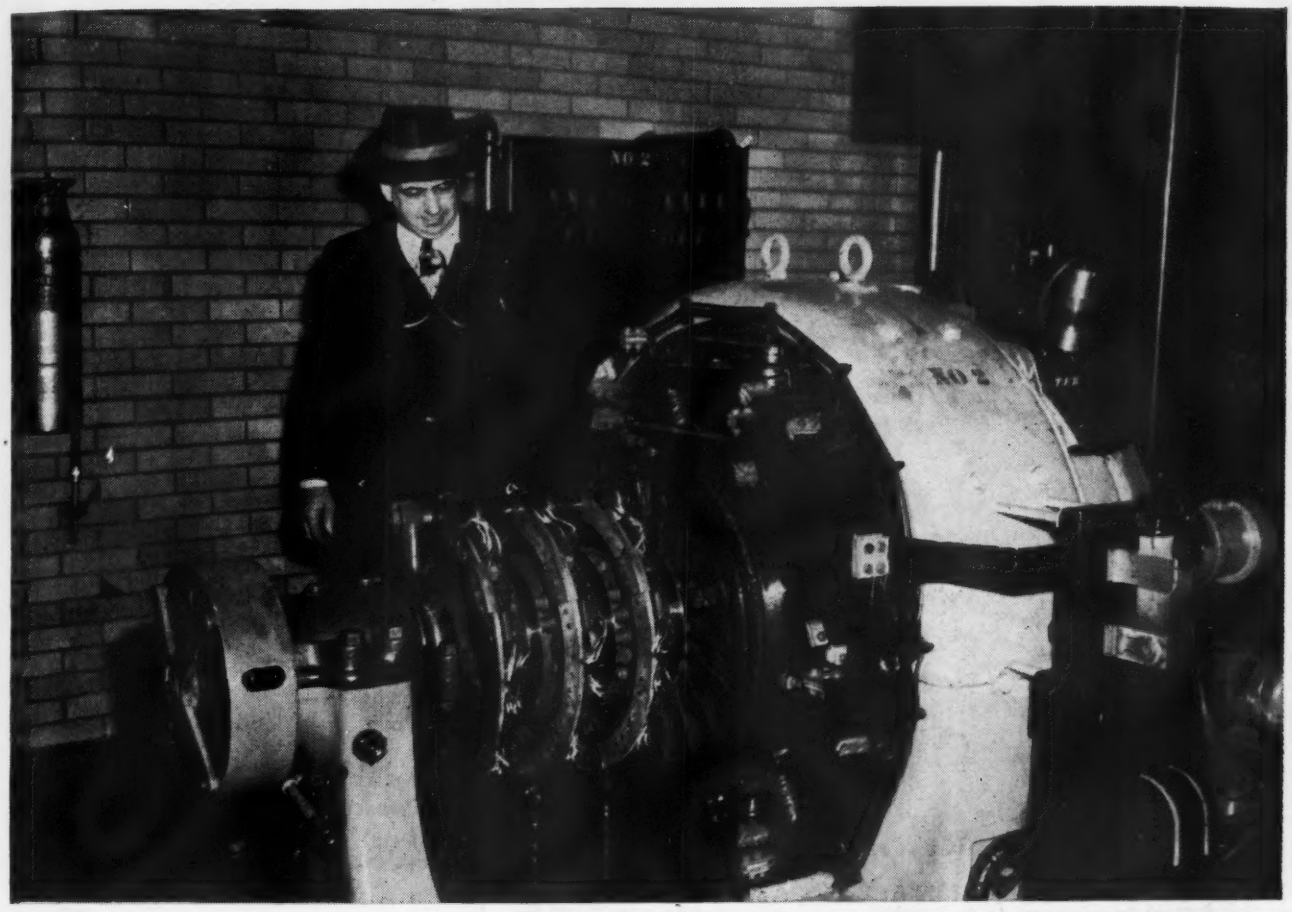

FIG. 2—Typical 500-kw. synchronous converter for six-phase input. Note the six slip rings and the tap coils on the armature. Fields are similar to those on a d-c motor.

poor power factor and/or high average loads. This condition is brought about in the following ways:

1—Over-excitation in the effort to maintain d-c voltage, which leads to burned-out shunt fields and low power factor; also unbalanced field conditions.

2—High a-c voltage setting to overcome line drop, which gives a low power factor. This, combined with high averaged loads, is almost certain to be fatal to the winding.

3—A combination of the above two when the shunt field is increased to compensate for the low power factor caused by increasing a-c voltage. This again, as in the first case, leads to unbalanced shunt fields, burned-out shunt field coils and low power factor.

A positive symptom of low power factor and high averaged loads is the presence of hot spots in the armature winding adjacent to tap coils. Normally, the hot spots in the windings are the tap coils, but these will not become dangerously overheated unless the machine is loaded above its capacity. Whenever an armature throws solder from a tap coil, it has been overloaded. If solder is thrown from coils adjacent to tap coils, low power factor is involved and the machine may or may not have been carrying a d-c overload. The farther the hot coil is from a tap coil, the lower the power factor has been and the less a d-c overload is indicated.

As already pointed out, the currents in a machine acting simultaneously as a motor and a generator must flow in opposite directions, and the current in any particular conductor will be the difference between the two. In any particular coil the direct current is constant in amount and direction from the instant the commutating segment connected to this coil passes the positive brush, to the instant it passes the negative brush and conversely from negative to positive brush. In any coil, midway between a-c taps, the alternating current is at maximum when the voltage in this circuit is maximum. This occurs when the mid-coil is at the center of a main pole, or half-way between the inter-polar positions. The current in this mid-coil varies from zero to maximum and back again as it passes from one commutating pole to the following commutating pole. Therefore, for the period of time that the direct current in a coil remains constant in amount and direction, there is also in it a variable current, changing from zero to maximum and back again. The net or resultant current has a wave shape and frequency defined by the difference of the straight-line d-c current and the sine wave curve of the a-c current.

A coil situated near one of the a-c taps will carry direct current subject to the same law as a mid-tap coil, but the alternating current in this coil is the same as that in the middle coil and has its maximum voltage at the same time as the middle coil and not when this particular tap coil is at the middle of the pole. The alternating current in this coil may, therefore, reach its maximum voltage soon after the conductor has passed a brush and the resultant of the two currents is greater than that in the middle coil. Thus, although the heating effect in a rotary converter winding is less than in a direct-current machine having the same capacity, it is different in every coil—minimum in the center coil, maximum in the

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coil nearest the taps, when power factor is held at unity.

When power factor is allowed to lag, the a-c current will lag behind the a-c voltage so that the curve of this current is not identical with the voltage curve, but is displaced by the angle indicated by the power factor and is increased in value. From this it is evident that, with power factor other than unity, the minimum resultant current is no longer at the middle coil, but is moved one way by leading current and the opposite way with lagging current. This will improve the heating conditions in one tap coil while the middle coil and the other tap coil will have a greater heating condition. The result is that the heating as a whole is increased and is not as uniformly distributed as with unity power factor.

These hot spots, caused by poor power factor and high d-c loads, will be evenly spaced around the entire armature winding. *Hot spots may also be caused by an unbalanced current condition arising from some defects in the a-c winding or a-c voltage supply —poor brush contact—a loose ring connection—or a defect causing an unbalanced condition in the transformer.*

Suggested Testing Procedure

In testing a synchronous converter station, *nothing should be taken for granted* unless it be that everything is wrong, and unless the source of trouble is obvious upon inspection. A suggested testing procedure involves checking the following:

1. A-C Voltage Supply
   (a) Check both primary and secondary voltage of the transformers.
   (b) See that all connections are tight.
   (c) Check tap connections of armature to see that connections are balanced.
2. A-C Brushes
   (a) See that a-c brushes work freely in holder; that pig-tails are good and tight; that brushes are fitted to the rings and that brush pressure is between 2 and 2½ pounds per square inch of brush surface.
3. D-C Brushes
   (a) See that the brushes are free in holder; and that pig-tails are tight in brush and securely fastened to brush stud.
   (b) See that brush spacing is accurate and that brushes are in line.

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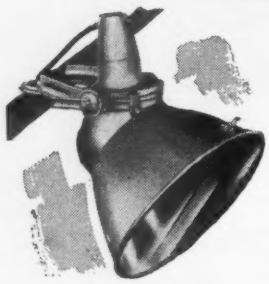

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(c) Check brush pressure and adjust to approximately 2½ pounds per square inch of brush cross-section.

(d) See that brush setting is on, or very near, mechanical neutral.

(e) Brushes normally will have an angle of 15 degrees trailing, and the spacing as checked from the trailing edge of the brush should not vary from correct position more than 1/16 inch.

4. Field Air Gaps
   (a) Main pole air gaps should not vary more than 12% from the average value.
   (b) Commutating pole air gap should not vary more than 3% average value.
5. Shunt Fields
   (a) Check for polarity, seeing that every other pole is a north pole and that every other pole is a south pole.
   (b) Take voltage drop across each coil; balance should not vary more than 10%.
6. Compound Field
   (a) See that polarity is the same as the shunt field on which it is mounted.
7. Commutating Field
   (a) See that polarity of commutating pole is opposite to that of the main pole just preceding, in the direction of rotation as viewed from the commutator end of the converter.
8. Commutator
   (a) See that commutator is smooth, and mica under-cut.
9. All Switchboard Connections
   (a) Examine both d-c and a-c switch connections and contacts to see that they are clean and tight.
   (b) Check protective devices for correct setting.
10. Running Test
    (a) Check commutation and adjust brushes to best position.
    (b) Adjust shunt fields so that at no-load a-c current is approximately 25% and lagging of full-load a-c current.
11. A-C Voltage, Power Factor and D-C Load
    (a) See that a-c voltage on ring is near rated volume.
    (b) See that the power factor is approximately unity at 100% load.
    (c) Check d-c load to determine whether or not the machine is operating above its capacity.

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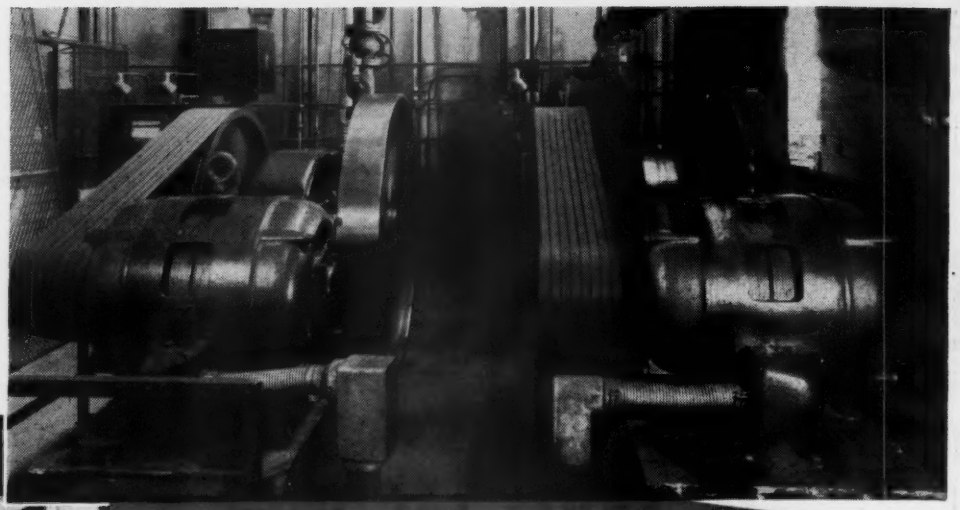

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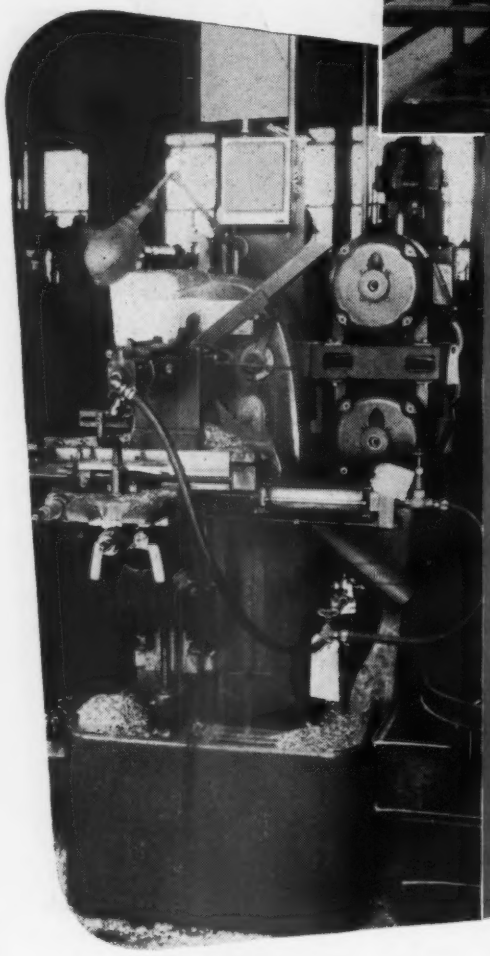

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Reader's Quiz

Induction Motor

QUESTION 321—*We have a dual (220-440) voltage, 3 phase, 25 cycle, 7½ hp. induction motor that does not conform to the action of other motors under the following test:*

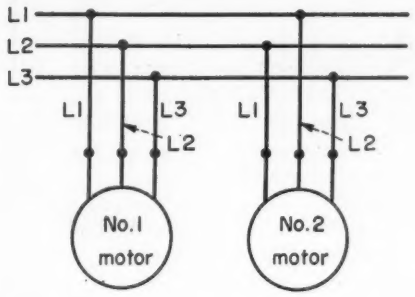
One Y group is connected to 220 volt and the rotor turns clockwise. This group is disconnected and the second group is connected to 220 volt and the rotor again turns clockwise. When both groups are connected in parallel, the rotor runs counter clockwise, unlike other motors in our shops. All coils have been checked out by kick tests to determine associated groups and proper polarities. We use N.E.M.A. markings. The motor runs a little warm, but is apparently O.K.—A.H.J.

A. TO QUESTION 321—The exact points of connection of the two motors to the 220 volt line are not clearly brought out in the question.

If the motors are connected through switches to the mains in the relative position shown in the diagram and the motors ran clockwise when each was connected separately, there is no reason to believe they would not both run clockwise when both switches are closed.

If both branch circuits to these motors are brought out as shown in the diagram and in each case marked L1, L2 and L3, but connected to the mains differently as shown, the leads from the motors can be connected to cause the motors to run in the same direction (clockwise).

Now if in making the test described in the question, No. 2 motor is connected in parallel with No. 1 motor to the No. 1 motor branch circuit, the motor lead shown connected to No. 2 branch circuit Lead L1 being connected to L1 of branch circuit No. 1 and the No. 2 motor lead shown connected to L1 of branch circuit No. 1 being connected to L2 of No. 1 branch circuit, the No. 2 motor would run in



the opposite direction or counter clockwise.

This, of course, is caused by difference in connections of the branch circuits to the mains.

If the test was conducted in the manner described, the main line wires can be traced and the branch circuit wires connected to the mains in proper sequence. In other words, the L1 lead in No. 2 branch circuit should be labeled L2 and L2 lead marked L1 and then connect the motors to run in the desired direction.—B.A.S.

A. TO QUESTION 321—A 3 phase motor will behave this way if the first Y reads A. B. C. and the 2nd Y reads B. C. A. or C. A. B. Change the leads until both windings will read A. B. C.—H.S.

Voltage Change

QUESTION 322—*One of our college buildings is being changed from 110 volts 3 phase to 120/208, 4 wire. We have one 1 hp. 3 phase, 110 volt motor that is inaccessible and we would rather not disturb it for rewinding. The motor is connected to an acid fume hood fan and rated at 1 hp., 110 volts, 6 amperes. This drive is over motored and as we find that 3 amperes are required to do the work, it is proposed to use GE CR 9006 resistors permanently connected to each leg regardless of the waste of current.*

Should the resistors be rated at full load current (6 amp.) or actual (3 amp.) as recorded by the instruments?—L.G.D.

A. TO QUESTION 322—Since the actual current requirement, which I presume from L. G. D.'s statement was made with the 120 volt supply, is only 3 amps., there would be no object in providing a current carrying capacity resistor of 6 amps. if there is little possibility of the motor being removed and used for other purposes. However, since the operation of this motor underloaded has a bad effect on power factor, a suggestion to replace it and use it elsewhere might be adopted. Its new location would undoubtedly require a more normal load. I would therefore suggest that the proper rated resistors (6 amps) be secured.—W.B.M.

A. TO QUESTION 322—Inso far as the motors on this drive will no doubt be shut down when not in use and restarted when being used, I would suggest that the resistors to be used for the particular motor have a rating of 6 amperes, at least, due to the fact that some electric motors have a starting current of 1½ to 2 times the full load current. It is impossible to say specifically just what the starting current will be for this motor off hand. Inasmuch as the running current of the motor was recorded as 3 amperes on the instruments, I suggest also recording the starting current of this motor and adding 10% to this value for a safety factor would give the exact current rating required or use the higher rating to these values made by the manufacturer.—L.C.D.

A. TO QUESTION 322—I would strongly suggest that resistors not be used for this application. Rather, two small autotransformers to handle around 400 watts each could be connected in open delta. They will do a beter job of converting from 208 volts to 110 volts than the resistors, and in addition the power saving will pay for themselves. Furthermore, there will be no heating problem as with the resistors.

The problem as to the size of the resistors to use is a little more complex than the writer assumes. If we assume that the motor has a power

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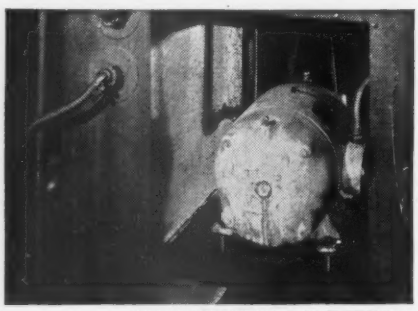

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The motor bearings were packed with DC 44 Silicone Grease and the frame was painted with DC Silicone enamel. The motors have now been in service over 10 months and show no sign of failure. A hazardous smoke problem caused by the burning of conventional finishes also has been eliminated.

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factor of 90% then the magnetizing current will be roughly 20% of full load current, or 1.2 amps. If the resistors are each 30 ohms, then when the motor is drawing 3 amps there will be a 90 volt drop across them. But a check will show that the voltage across the motor will be greater than 118 (208-90) owing to the fact that the motor is an impedance and not a pure resistance. Another difficulty is that at starting the resistors cause the voltage to be too small. This may cause trouble with the starter.—H.H.S.

A. TO QUESTION 322—Since the drop in voltage from 208 volts to 110 volts is to be accomplished by IR drop, L.G.D. must use the three ampere value of current in figuring the resistance required.

If the resistance was figured for a six ampere flow of current and the actual load current is three, the motor voltage would be too high.

However, I do not believe this method of procedure will be satisfactory.

The locked rotor current of a 1 hp. 110 volt three phase motor is approximately 40 amperes, and since only a fractional part of this value of current can be forced through the required resistance by the impressed voltage mentioned, the voltage at the motor at the first instant of starting will be too low to furnish the required torque to turn the motor over.

Would advise installing a three phase transformer or three single phase transformers or perhaps better yet, since the motor is running at half load, two single phase transformers with secondaries connected in open delta. —B.A.S.

Can you ANSWER these QUESTIONS

QUESTION 15B — Some fluorescent starter companies suggest that a fluorescent lamp may start faster by reversing the starter. How can this happen on alternationg current?—H.S.

QUESTION 15C—In a 3 phase circuit, can a closed delta transformer bank be successfully operated in parallel with an open delta bank? Both banks are made up of single phase transformers, all five transformers alike in rating, ratio, and impedance. The two banks are located quite a distance apart, and both the primary and secondary lines connecting them of comparatively high impedance. The load is fairly uniform along the entire length of the line between the two banks.—W.B.S.

PLEASE SEND IN YOUR ANSWERS BY SEPTEMBER 15

IN JUST 5 SECONDS!

FLEXITIP— easily formed.
LONGER 8" REACH
5 SECOND HEATING— no waiting, saves power.
SOLDERLITE — spotlights the work.
BUILT-IN TRANS-FORMER
DUAL HEAT— single heat 100 watts, dual heat 100/135 watts; 115 volts, 60 cycles.

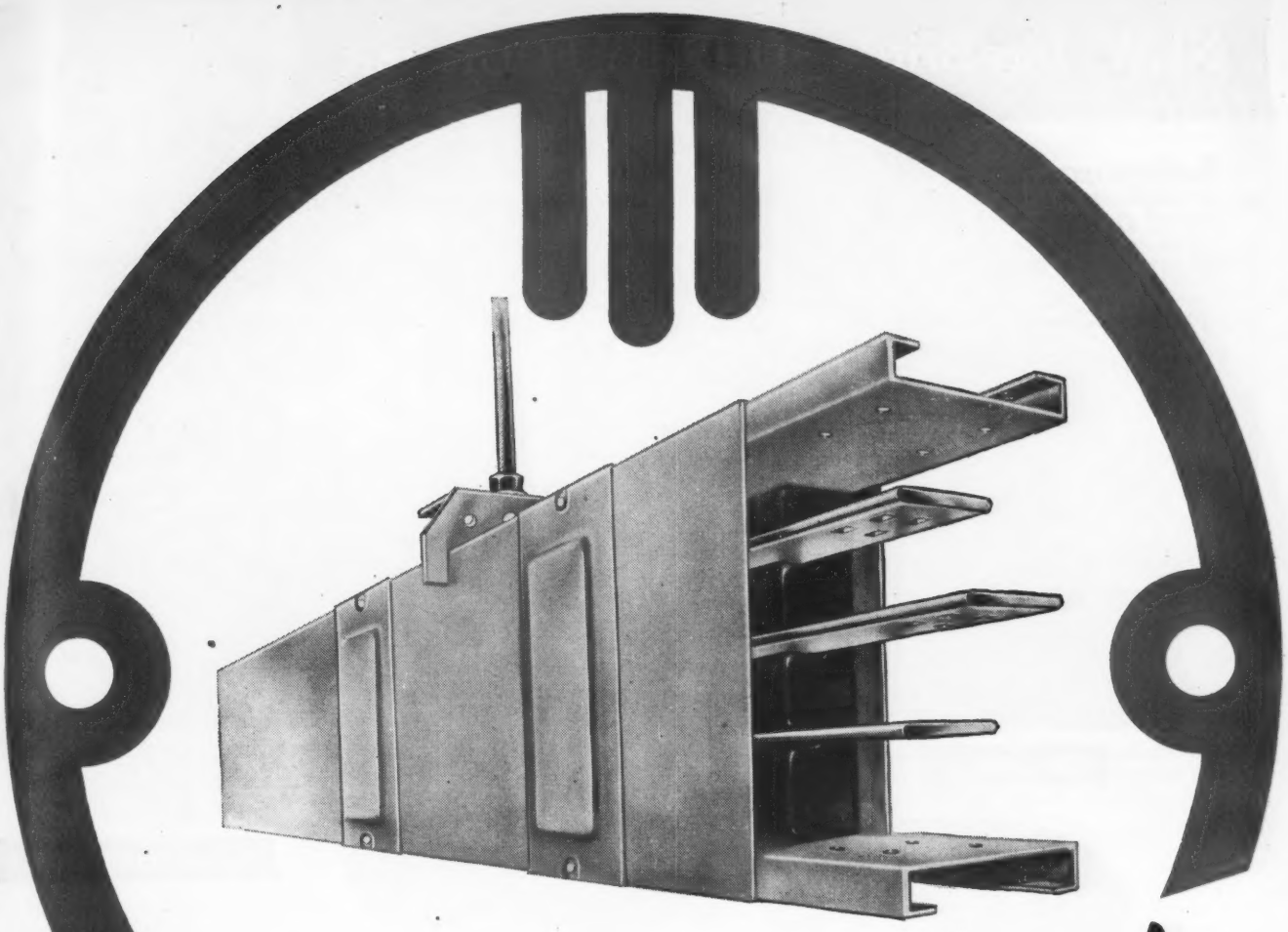
Pull the trigger switch, make contact, and you solder. Then release the trigger and off goes the heat—automatically. No wasted time. No wasted current. No need to unplug the gun between jobs. The Weller Gun's Flexitip heats *only* when in use—saves hours and dollars. Your Weller Gun will pay for itself in a few months.

Solderlite, extra length, and the easily shaped Flexitip mean real soldering ease. And because the transformer is *built in*—not separate—the Weller Gun is a complete, self-contained unit, compact, convenient.

For laboratory and maintenance work, we recommend the efftient 8" model—DX-8 with dual heat; or 4" types S-107 single heat and D-207 dual heat. Order from your distributor or write for bulletin direct.

Be sure to get your copy—SOLDERING TIPS, the new Weller Handy Guide to easier, faster soldering—20 pages fully illustrated. Price 10c at your distributor's.

WELLER
MANUFACTURING COMPANY
815 Packer Street • Easton, Pa.



Outlets every foot!

Plus greatest plug-in safety . . . Federal Noark Bus Duct

FOR PLUG-IN POWER where you want it, when you want it, be sure you get the *extras* that come in industry's "convenience outlets"... Federal Noark Bus Duct. Utmost flexibility...insulated openings for complete safety in applying and removing plug-in devices.

Federal Noark Bus Duct has four-channel strength—sides, top and bottom are all rigid. Rugged bus bar insulators are mounted on 12" centers for high electrical safety and mechanical strength. Adjustable hangers reduce both installation time and cost. Contacts at bolted connections are silverplated.

See your Federal Distributor about Federal Noark Bus Duct. And write us for your copy of Bulletin 180 giving full descriptions and data. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

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BUS DUCT

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Bus Duct ★ Sales offices in principal cities.

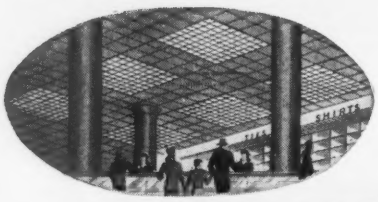
NEW! Day-Brite's FOUR-BY-FOUR unit

Incorporating the most advanced principles of integrated lighting, offering new architectural possibilities

FOR OFFICES

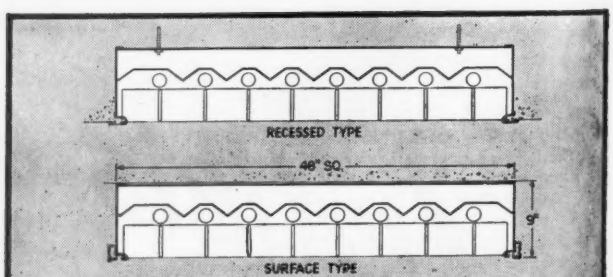
SMALL RETAIL STORES

ENTRANCES, LOBBIES

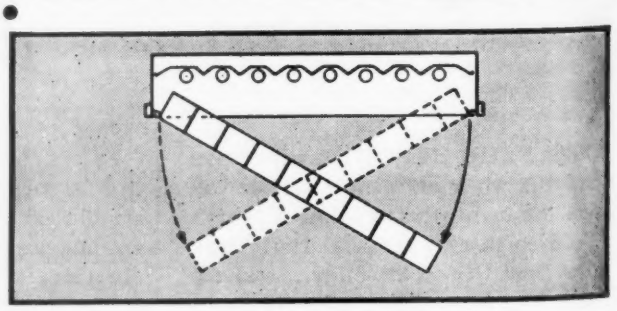


LARGE DEPARTMENT STORES

Day-Brite's Four-by-Fours are engineered for both recessed and surface mounted applications. They can be used with 6, 8, and 10 40-watt fluorescent lamps. Knockouts are provided for feed connections. Plaster frames are available for use when fixtures are recessed.



Separable hinges on both sides ot louvers allow hinging from either side for easy servicing. Exclusive Day-Brite BOXCO louver assembly has double-wall louvers interlocked for extreme strength and rigidity. Fixtures are rust-inhibited and finished in Hot-Bonded Super-White enamel throughout.



IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

239

Write NOW for descriptive Bulletin 20-C

Day-Brite Lighting, Inc., 5402 Bulwer Avenue, St. Louis 7, Missouri

In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario

Day-Brite fixtures are engineered for every seeing task. Distributed nationally through leading electrical wholesalers.

Modern Lighting

Old buffing department had belt driven, single-pedestal, buffing machines and combination incandescent-mercury lighting producing about 8 foot-candles.

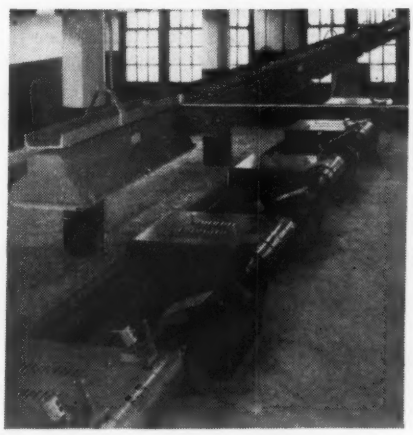
New buffing room with modern double-spindle machines and dust collecting system has continuous row of dust-tight fixtures centered above spindles.

Lighting a Buffing and Polishing Room

A new buffing and polishing room is part of the complete plant modernization program at The Liquid Carbonic Corporation in Chicago. Under the old layout, single-pedestal buffing machines were driven by a maze of line shafts and belts. A staggered system of 500-watt incandescent RLM units and combination incandescent-mercury fixtures on 12-foot spacing at an 11-foot mounting height produced a bare eight foot-candles of lighting intensity. This was further reduced by heavy deposits of lint thrown on the reflectors by the slapping belts. Fixture maintenance was relatively high.

All of this is now part of plant history. The new buffing and polishing room is equipped with modern double spindle buffing machines (separate motor and control for each spindle); underfloor dust collecting system with a separate RotoClone for each group of machines; continuous row fluorescent lighting over the machine spindles.

The new lighting consists of dust-tight RLM type fluorescent fixtures, each containing two 40-watt, 3500° white lamps. An opal glass diffusing cover on each unit eliminates specular reflections on the chrome and stainless steel parts that are polished. There are two units for each machine, one unit centered directly above each spindle. Fixtures are mounted 8½ feet above the floor on an inverted 6-inch steel channel with welded strap



Closeup view of fixtures showing details of channel-iron suspension resulting in perfect alignment with fewer vertical tie rods. Circuit conduit lies in channel. Brackets prevent sway.

supports for vertical tie rods. The channel provides rigid, perfect alignment in both the vertical and horizontal planes; accommodates the branch circuit conduits and connection boxes. A total of five hangers and three anti-sway brackets (fastened to building columns) support the group of ten fixtures on the channel. Each group of two fixtures is controlled by a switch.

Lighting intensity at buffing wheel height averages better than 40 foot-candles. Maintenance consists of wiping off the glass cover at least once a week, a chore that the buffing machine operator can do.

Similar fixtures are installed in the new soda fountain plant addition for in-line buffing operations. Here the units are individually suspended 9 feet above the floor and in tandem fashion with a 2-foot space between ends of units to accommodate a power trolley duct for portable electric tools. Rows of fixtures are on approximately 8-foot centers to line up with the dust collector hoods and work immediately in front of them.

Troffers Light Conference Room

The official conference room of the Department of Agriculture, Washington, D. C. uses a unique lighting system to provide efficient lighting on the conference table. The lighting layout consists of two rectangles of Miller Company troffers installed flush in the Celotex acoustical tile ceiling. The troffers are of the 2/40-watt fluorescent type, and are lamped with 40-watt 3500 degree white fluorescent lamps. Flat Albalite glass panels are installed flush in the bottom of the troffers to conceal the fluorescent lamps and to provide light diffusion.

One rectangle is located within the other. The large rectangle is 14 ft. by 28 ft., outside dimensions, and contains 20 4-ft. troffer units. The small rec-

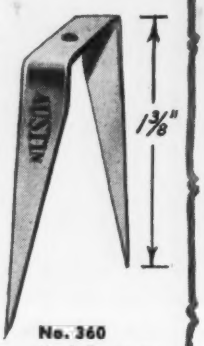
AUSTIN
"DRIVE-IN"
CABLE STAPLES

No spreading or buckling with Austin staples! Made of heavy, selected temper, round edge flat wire with sharp, burr-free points.

Flat across top — no spreading or buckling.

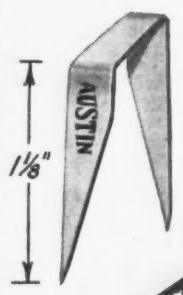
The shoulders are square and strong—drives easily and accurately.

Long taper to point — staple held firmly at the first tap of hammer.



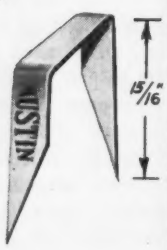
No. 360
Made for armored cable. Available without indenture in top for non-metallic sheathed cable —Cat. No. 361.

No. 362
Designed specifically for non-metallic sheathed cable. Made shorter for easier driving.



Stamped of heavy, selected temper, round edge flat wire.

Sharp, burr-free points—staple starts easily in any wood.



No. 363
The new staple is specially designed for small diameter non-metallic sheathed cable. Small in size — easier to drive.

Austin staples are conveniently packed in sturdily made, metal edge cartons of 100 and 500, and in cases of 2500.

The M. B. Austin Company
NORTHBROOK, ILLINOIS
3185

Flush fluorescent troffers installed in geometric pattern provide two-intensity lighting for the official conference room, Department of Agriculture, Washington, D. C.

tangle is 4 ft. by 14 ft., outside dimensions, and contains eight 4-ft. troffer units. The rectangles are controlled by separate switches, so that either or both may be turned on, as desired. These rectangles are centered over the conference table so that the continuous line of troffers of the larger rectangle is located above the outer edge of the table, and approximately directly above persons seated at the table. This choice of location serves to diminish troublesome reflections of light from the troffer surfaces for specular or glass material when laid flat on the table.

The lighting intensity on the conference table is approximately 45 footcandles when the outer rectangle only is lighted, and may be increased to approximately 75 footcandles on the table by lighting both rectangles. The total area of the room is 1190 square feet. Rug and draperies are gray.

Shadowless illumination is provided for this municipal parking lot in Manchester, New Hampshire, by recently installed General Electric Form 101-D 16,000-lumen mercury-vapor luminaires. Mounted on ornamental metal standards, these units provide uniform high-intensity lighting over the entire parking area. The engineering layout was prepared jointly by J. L. Calpin of the Public Service Company of New Hampshire and H. E. Wilson, G-E lighting specialist, in cooperation with Ernest W. Graupner, city engineer, and the Aldermanic Traffic Committee of Manchester.

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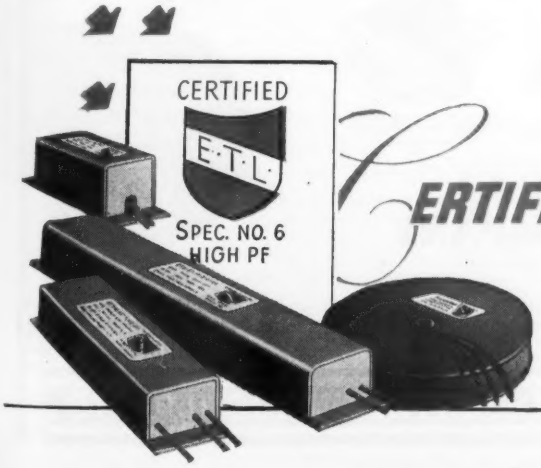
Certified Ballasts give a high ratio of fluorescent light output to the input of power —deliver more light for the electricity used.

When you specify Certified Ballasts, your customers are assured of:

Rated light output
Full lamp life
Dependable performance

Because Certified Ballasts are made to exacting specifications, then tested and checked by Electrical Testing Laboratories, Inc., an impartial authority, they assure customer satisfaction—and proved economy.



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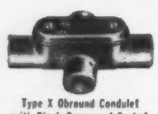
for electrical installations that are exposed to weather, moisture, steam or non-combustible dusts

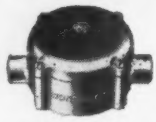
JUNCTION CONDULETS - SWITCHES - RECEPTACLES - LIGHTING FIXTURES - CIRCUIT BREAKERS - PANELBOARDS

The illustrations show a representative selection from the hundreds of CONDULETS that are vaportight or when furnished with covers and gaskets become vaportight.

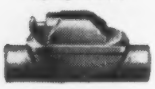
*CONDULET is a coined word registered in the U.S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

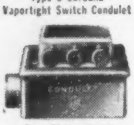

Type X Obround Condulet with Blank Cover and Gasket

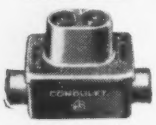
Type FSC Condulet with Blank Cover and Gasket


Type GSC Condulet with Blank Cover and Gasket

Type CRT Vaportight Condulet


Type C Obround Vaportight Switch Condulet


Type FS Vaportight Triple Switch Condulet


Type FSC Vaportight Push Button Station Condulet

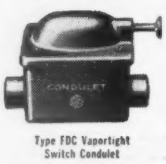
Type FSC Vaportight Plug Receptacle Condulet

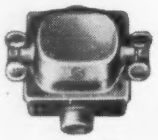
Type VPH Vaportight Indirect Lighting Condulet 150 – 200-Watt

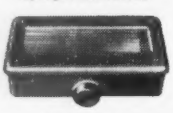
Type AHC Vaportight Flexible Fixture Hanger

Type FS Vaportight Switch Condulet

Type FD Vaportight Switch Condulet

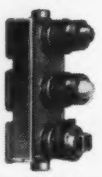

Type FDC Vaportight Switch Condulet


Type FS Two-Gang Vaportight Switch Condulet


Type FS Vaportight Lighting Fixture

Type FSC Two-Gang Tandem Condulet with Vaportight Switch and Plug Receptacle

Type VDB Vaportight Lighting Condulet 300 – 500-Watt

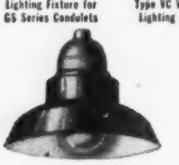

Type FCP Three-Gang Vaportight Panel Mounting Condulet with Pilot Lights and Switch

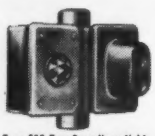
Type VGR Vaportight Lighting Fixture for GRF Series Condulets

Type GS Vaportight Lighting Fixture for GS Series Condulets

Type VG Vaportight Lighting Condulet

Type GS Vaportight Lighting Fixture for GS Series Condulets


Type VDA Vaportight Lighting Condulet with Dome Reflector 100 – 200-Watt


Type FSC Two-Gang Vaportight Combination Push Button Station and Pilot Light Condulet

Type V Vaportight Lighting Condulet for Mounting on Machines

Type V Vaportight Heavy Duty Lighting Condulet with Shatterproof Glass

Type VDA Vaportight Tank or Vat Light Condulet

Type ARC Vaportight Lighting Fixture for Obround Condulets.

Type VC Vaportight Lighting Condulet

Type V Vaportight Lighting Condulet with Dome Reflector 300 – 200-Watt

Type VDA Vaportight Lighting Condulet

Type VXHA Vaportight Lighting Condulet with Flush Hubs

Type VR Vaportight Lighting Condulet for Mounting on a Hand Rail

Type VXJ Vaportight Lighting Condulet for Extensions from Concealed Conduit

Type VS Vaportight Hand Lamp with Rubber Handle

Type VDA Vaportight Lighting Condulet with Angle Reflector 100 – 200-Watt

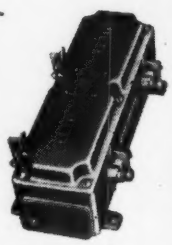
Type RCD-S Vaportight Lighting Fixture for Wall Mounting

Type VFC Vaportight Gauge Lighting Condulet

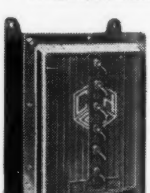
Type WV Vaportight Lighting Condulet with Fresnel Lens

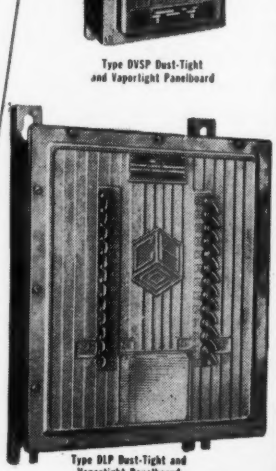
Type VJ Vaportight Lighting Condulet

Type VLG Vaportight Gauge Lighting Condulet Fluorescent


Type VSW Vaportight Circuit Breaker Condulet

Type DVSP Dust-Tight and Vaportight Panelboard


Type DVSP Dust-Tight and Vaportight Panelboard


Type DLP Dust-Tight and Vaportight Panelboard

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Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.
and
GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

Questions on the Code

Number of Outlets On Circuit

Q. *In wiring a farm residence, I intend to use No. 12 wire armored cable throughout. There will be two lights which will be placed on a single circuit in the house and the rest of the equipment will be receptacles. Some of the receptacles will be on single circuits, others I desire to group. May I place five or six receptacles on one circuit?*—W.P.

A. As long as the number of circuits provided are based on the 2 watts per square foot rule, plus a No. 12 wire circuit for the receptacle outlets in the kitchen, dining room, pantry and laundry location, as many outlets may be placed on these circuits as is desired.

Of course the circuits feeding the rooms mentioned above must not be run to lighting fixture outlets. While the No. 12 wire circuits for the receptacles in the above rooms may be used at 20 amps., some of the circuits supplying receptacles for lighting may contain equipment, which would restrict the fusing to 15 amps. These smaller fuses are to be recommended anyway for better protection.—F.N.M.S.

Underground Conductors

Q. *I installed some underground cable last summer and had two faults on less than 500 feet during the past winter. Now I find that the cable sold me was of the thin wall variety and that most cable manufacturers also make an underground cable with the exterior wall of insulation several times thicker. Does the Code approve the thin wall outer civer?*—L.W.

A. The N. E. Code does not contain sufficient coverage for underground conductors as yet. However, it does state that such conductors must be of the type approved for such use. For competitive reasons a number of cable manufacturers do have an underground type conductor on the market that has an extremely thin outer jacket. Such a cable is sand under paving may give a satisfactory life, but it certainly should never be used elsewhere. A considerable amount of trouble has been experienced by contractors that have installed the thin jacketed cable not realizing that a much better cable could be obtained at a very slight increase in cost. Therefore whenever you purchase underground Type USE conductors or cable, be sure to specify the thick jacket type which bears the Underwriters' Laboratories label.—G.R.

Church Wiring

Q. *How are we to determine what type of wire shall be installed in a church? Is there a code on churches which says Rome, B-X or conduit?*—A.V.C.

A. The National Electrical Code does not specify what type of wiring is to be used in a church. Some local ordinances or codes define a church as a place of public assembly and then specify what types of wiring may be employed in such occupancies.

Certainly churches should be more carefully wired and with better materials than any other type of building except, possibly, hospitals, for there we are dealing with assemblages composed largely of women and children.

Sorry to say many frame churches as well as hospitals are wired in a deplorable manner which constitutes actual hazardous conditions.—F.N.M.S.

Wiring a Service Station

Q. *When wiring a gasoline service station, can one use a single circuit to operate the three pumps on the island or must each pump be supplied by its own circuit?*—A.N.S.

A. The N. E. Code will permit the connection of the three motors operating the gasoline pumps to a single circuit providing each motor has individual running protection. This is not an advisable method to use due to the fact that these pumps are frequently changed and should they be served from a common circuit all pumps would be out of service during such changes. Permission to supply more than a single motor by a common circuit will be found under Section 4343 of the Code.

Circuits supplying the gasoline dispensing pump motors must be controlled by a switch which opens all circuit conductors. This will be found under Section 5142-e of the Code. This requirement is placed in the Code to assure safe removal of one of these units. If the control switch did not open the neutral as well as the ungrounded conductors, it would be possible for unbalance of load to have some current on the neutral which could cause a spark when the neutral is disconnected from the pump motor, and a spark within the pump housing could be disastrous.—G.R.

T.W. or Lead Covered Wire

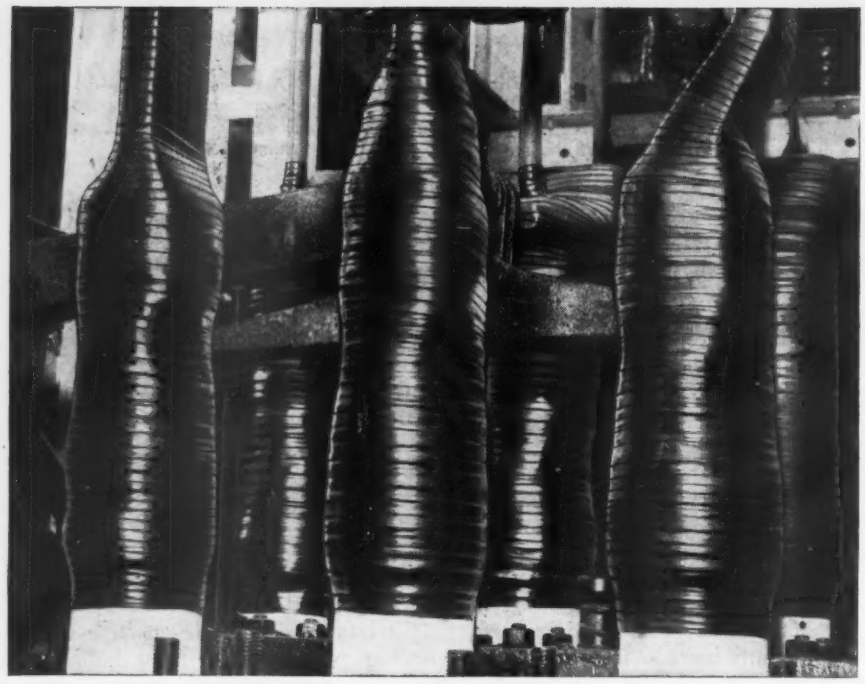
Q. *Has it been ruled on to use T. W. wire for gas pump installations? We are told only lead covered cable.*—T.M.

A. Underwriters' Laboratories do not list any Type R or Type T wires for use where exposed to gasoline. The National Electrical Code does not recognize T. W. for such use. Some Inspection Bureaus, however, have permitted T. W. wire to be used in gasoline dispensing pumps.

The local inspection bureau should be consulted about this.—F.N.M.S.

Water Pump

Q. *I am wiring a dairy farm which is metered on a pole. The pump is 10 feet from the main switch and meter. The owner wants the pump wired from the line side in case of fire. I had planned to come off top of the main switch in conduit under*



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ground to a fused switch inside pump house then to pump; this I was told was wrong. What is the correct method to wire this pump?—B.M.

A. Evidently the owner wants the pump to be used as a fire pump as well as a pump for water for general uses, so why not do it this way and be within Code requirements? The Code permits more than one service switch so use two. One will be a service switch for everything except the pump motor and the other will be a service switch for the pump motor.

The service switch for the pump motor will be selected at 300% (or possibly 400%) of the motor rating so that fuses at 300% of the motor rating can be used. Then the switch in the pump house will be the motor controller. This would have to be rated in horsepower at the rating of the motor.—F.N.M.S.

License

Q. *Does an inspector have to be a licensed electrician in order to inspect the work of other licensed electricians?*—A.B.

A. This depends upon whether or not the law under which the inspector operates requires that he be a licensed electrician in order to qualify as an inspector.

Some places have such a requirement, but others do not. There are probably more of the latter—F.N.M.S.

OFFICIAL INTERPRETATIONS

Chapter 10. Interpretation No. 316. Issued April 28, 1949. Tables 4, 11 and 13.

QUESTION 1: Is it the intent that Table 4, of Chapter 10, be applied in new construction without exception on account of type of insulated conductor?

ANSWER: Yes, with respect to the number of conductors and their sizes and types as given in the sub-heading of the table.

QUESTION 2: Is Table 13, of Chapter 10, intended for use replacing section 3005, paragraph e, of the 1940 edition of the National Electrical Code?

ANSWER: No, the third and final, across-the-page item of Table 11 is to apply to the conditions to which the text of this section of a former edition applied.

QUESTION 3: Should Table 13 of the 1947 edition be used for numbers, sizes, and types of conductors and sizes of conduit or tubing covered in Table 4?

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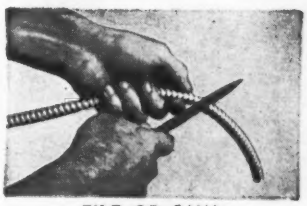
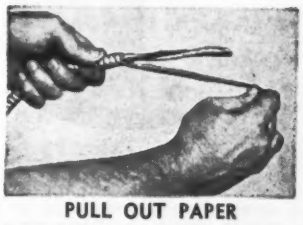


FILE OR SAW

BREAK



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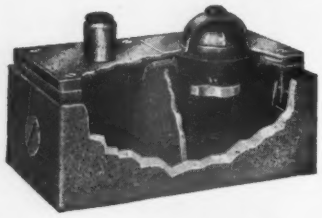

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ANSWER: No, Table 13 and its footnotes are applicable in applying Table 11, as stated in the first note following Table 11.

Section 2304. Interpretation No. 318 Issued March 28, 1949. Service Conductors Supplying Out-Building.

QUESTION: Does the Code require service wires larger than No. 10 to supply a small out-building containing only a ½ HP, 220 v. motor and four lighting outlets?

ANSWER: Paragraph a of Section 2304 of the 1947 edition of the Code is satisfied by a No. 8 service conductor.

Section 2352. Interpretation No. 319. Issued March 28, 1949. Connections Ahead of Disconnecting Means.

QUESTION: May current transformers, commonly called current coils, used in connection with the metering, on services of over one hundred amperes, be considered as an approved connection ahead of the disconnecting means?

ANSWER: Yes.

Section 5121. Interpretation No. 320. Issued April 18, 1949. Residential Storage Garages.

QUESTION 1: In the caption of section 5121 what is the import of the word "storage"?

ANSWER: The implication is that the garage in question does not contain unrelated equipment and is not ordinarily used for extensive or professional repairing of automobiles.

QUESTION 2: Does a one or two car private garage in connection (attached or detached) with a residence come under section 5121?

ANSWER: Yes.

QUESTION 3: In section 5121 should the reference to "Article 300" be to Article 300 or to Chapter 3?

ANSWER: Chapter 3.

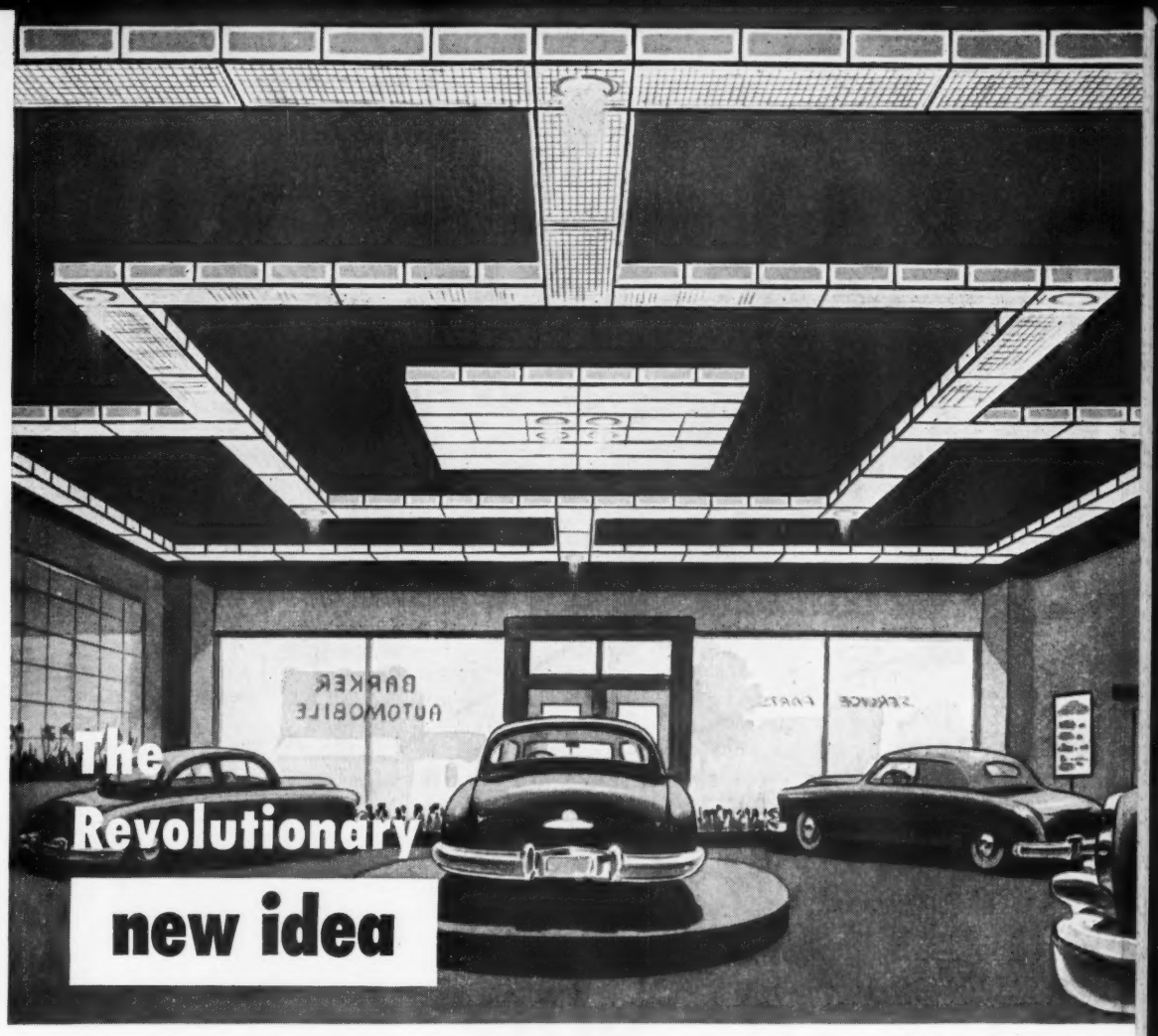
QUESTION 4: Does section 5121 permit the use of the flush type attachment receptacle in a one car private residential garage provided it is kept 4 feet or more above the floor, or does section 5105 govern?

ANSWER: The very special type described in section 5105 is not called for.

Section 2116. Interpretation No. 321. Issued March 29, 1949. Calculation of Load.

QUESTION: To what space of a store occupancy does section 2116 intend that calculations shall assume lighting loads will continue for long periods of time?

ANSWER: All spaces generally available to the public.



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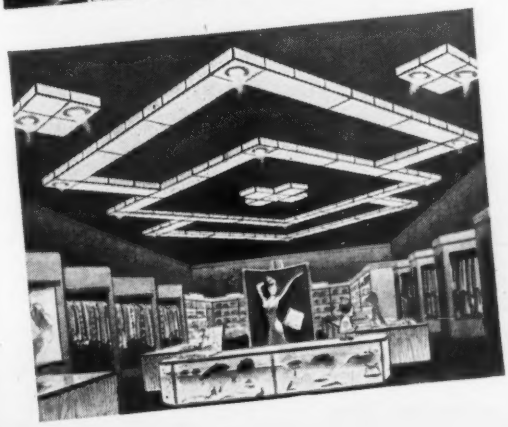

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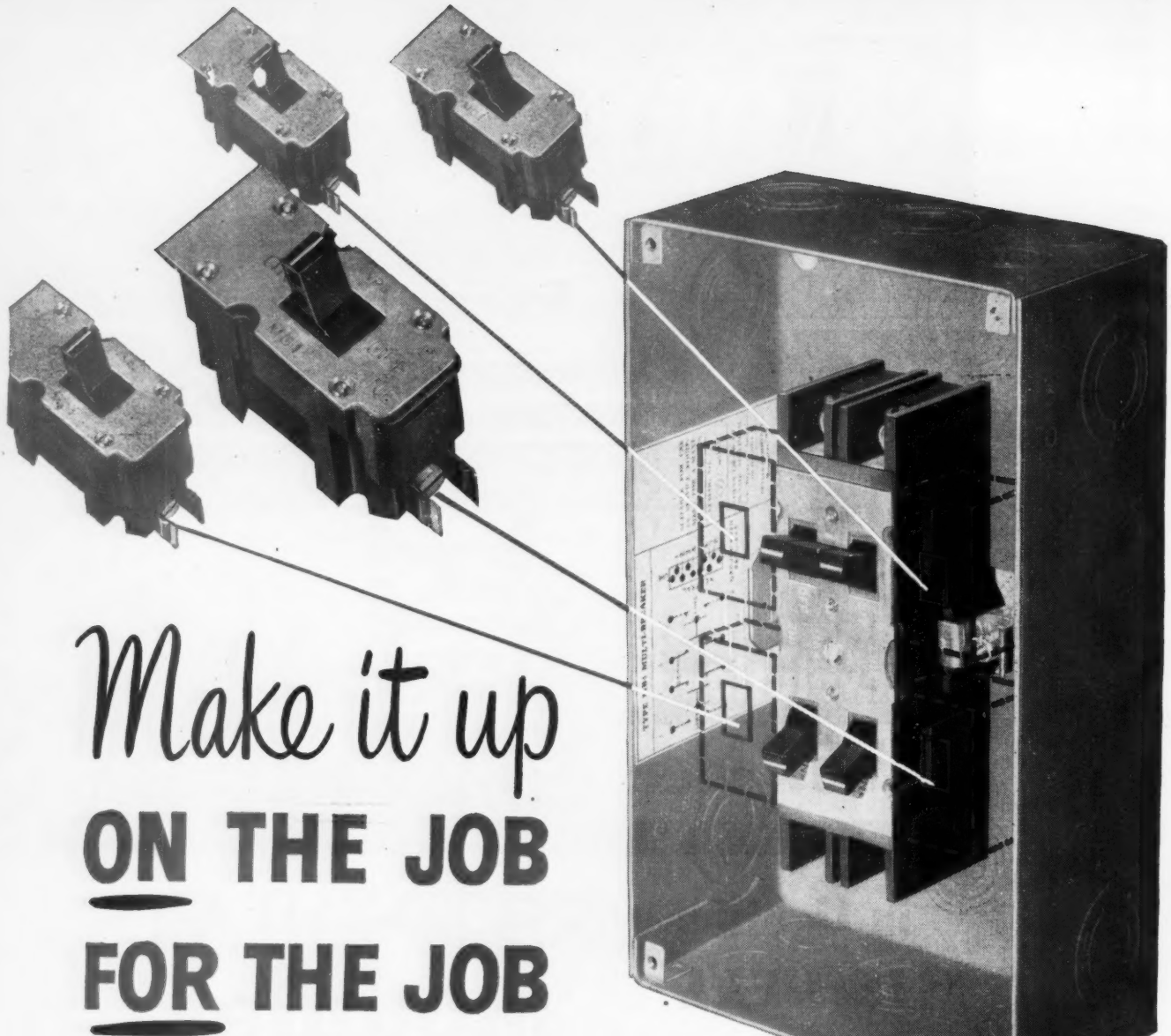

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In the News

N. Y. State Contractors Meet at Saranac Inn

The New York State Association of Electrical Contractors and Dealers, Inc., held their Golden Anniversary Convention at Saranac Inn, N. Y., from July 2 to 9. This was the largest meeting in their history, with registration totalling 350 men and women from all parts of the state.

A. Lincoln Bush, chairman of the board, opened the convention and presided at the Tuesday morning session, "Contractors Day." Ray W. Mitchell, president, gave the address of welcome to the convention.

J. D. Lynett, Superintendent, Bureau of Electricity, New York Board of Fire Underwriters, New York, stressed the importance of electrical inspections. He explained that during the war years, due to shortages and scarcity of materials, substitutions and deviations from the code had to be made. But with standard approved materials now available, he said that the Bureau is being asked to approve installations where substandard of substitute materials are still being used. Mr. Lynett said that the Code must be enforced and urged all contractors to use the approved material in their work.

"The National Program" was discussed by Paul M. Geary, executive vice-president, National Electrical Contractors Association, Inc., Washington, D. C. He told of the objectives of NECA and what the Association is doing for its members. Mr. Geary discussed in detail the public relations program, the work of the standards committee, the research and educational program and how the field service operates.

The organizational set-up, contract procedures, the construction program, electrical engineering and installation practices of atomic energy were discussed by George L. Ryan, director, staff engineering division, New York Operations Office, U. S. Atomic Energy Commission, N. Y. He said that all contractors who expect to be in business 25 years from now should investigate the possibilities of atomic energy today. All installations have to have electrical work and this is being done by electrical contractors. He outlined the number of laboratories that have been or are being erected and described the amount of electrical work necessary to complete these projects. He said that industry is doing the development work on atomic energy and they are calling upon the electrical contractors and electrical engineers to help them.

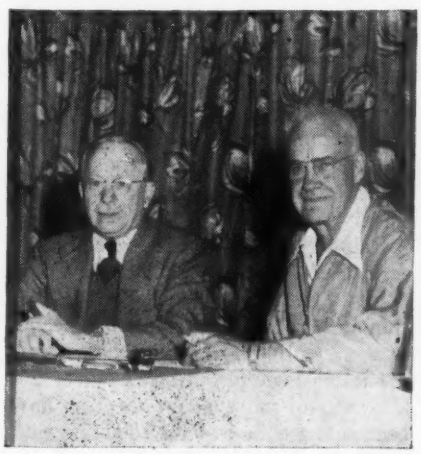
Mr. Ryan told about a file listing architects, contracting firms, engineers, electrical contractors that he is establishing in New York. They are finding out what type of work they are best qualified to handle; what size of job they are geared to handle, and the range of the area in which they operate. Mr. Ryan explained that all contracts are on a cost-plus fixed-fee basis. He pointed out that insofar as possible, they are following the National Electrical Code, city ordinances, and county ordinances.

Mr. Ryan urged all electrical contractors who are interested in doing this work, to file an application with his office, 70 Columbus Avenue, New York City, if they have not already done so.

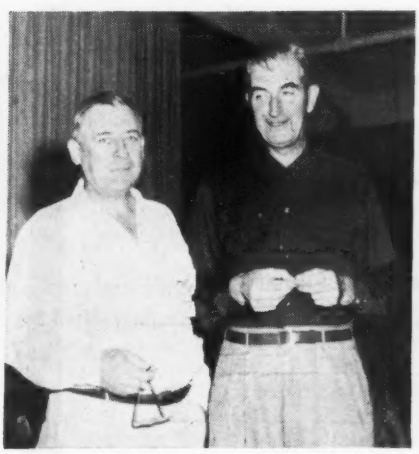
Thomas G. Gorman, sales director, New York State Insurance Fund, New York, discussed the "New York State Non-Occupational Disability Benefits Law." He said that beginning January 1, 1950, employers would be called upon to deduct from the employees weekly check one-tenth of one percent, not to exceed six cents per week. The employer contributes an additional six cents. This money is turned over to the chairman of the compensation law to set up a fund to be known as the "Unemployment Disability Fund".

Herman L. Weisman, counsel, Joint Industry Board of the Electrical Industry, New York, acted as moderator for the discussion following Mr. Gorman's talk.

Wednesday was "Utilities Day" and this was conducted by E. A. Brand,



A. Lincoln Bush, Belmont Electric Co., New York City, and R. W. Mitchell, Wipperman & Mitchell, Inc., Buffalo.



T. C. Lindholm, General Electric Co., New York, and E. G. May, E. G. May, Inc., Albany, N. Y.

P. M. Geary, National Electrical Contractors Assn., Wash., D. C., and G. L. Ryan, U. S. Atomic Energy Com., N. Y.

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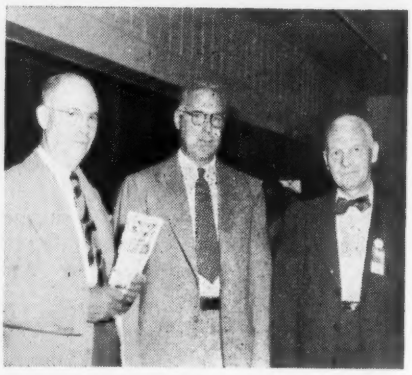


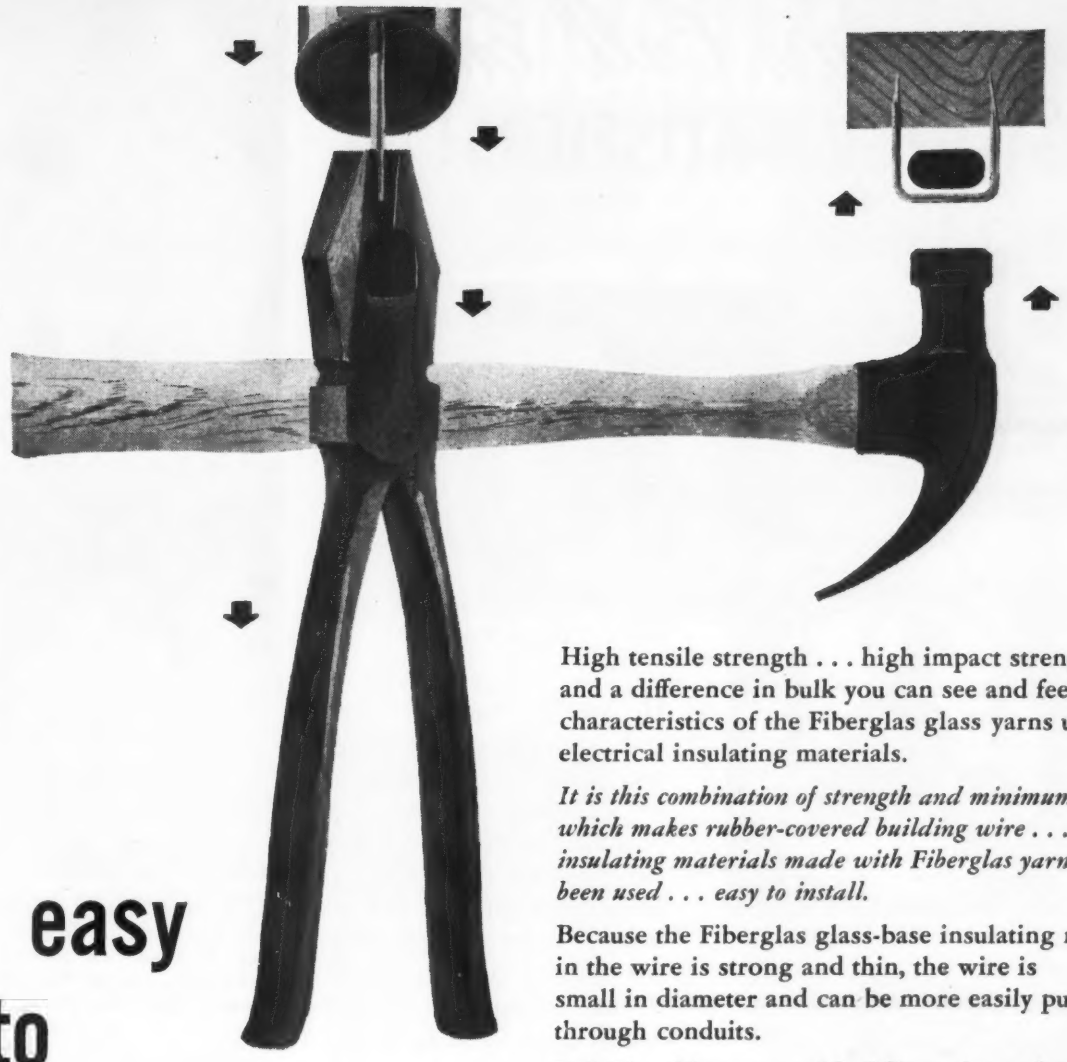
R. P. Wagner, New York Power & Light Corp., Albany; E. R. Acker, Central Hudson Gas & Electric Corp., Poughkeepsie, and T. F. Barton, General Electric Co., New York City.

commercial manager, Buffalo Niagara Electric Corp., Buffalo, N. Y.

The first talk was on "Radiant Electric Space Heating—The Next Big Market?" by Robert Archer-Shee, director of engineering, Continental Radiant Glass Heating Corp., New York. He said that electric heating had been making great strides in this country during the past few years. Electric heating, he said, should not be sold as an appliance but as a tailored electric heating system. Selling requires a special knowledge of heating engineering and each job is engineered from a heating standpoint. It is then given to the contractor to design the necessary wiring in accordance with the codes. Mr. Archer-Shee said that an installation complete with ten panels and probably four or five thermostats and all necessary wiring, would cost about $700.

Ralph P. Wagner, commercial manager, New York Power & Light Corp., Albany, N. Y., spoke on "The Utility's Supply Problem in Radiant Electric Space Heating". He said that it is a profitable load for utilities. Over 200 kilowatts of radiant space heating have been sold and he expects 1000 kilowatts on his line by the end of this year.

"Rochester Contractors Profit with Planned Lighting" was discussed by



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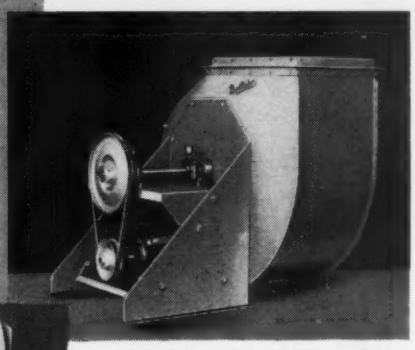

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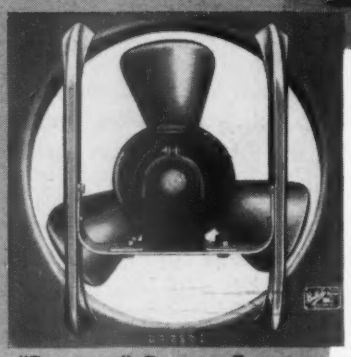
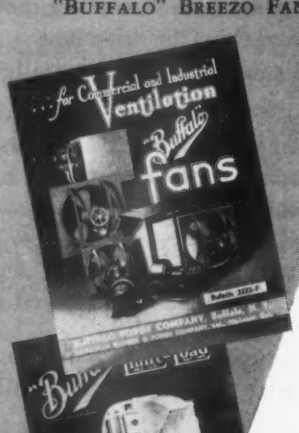


"BUFFALO" BREEZO FAN



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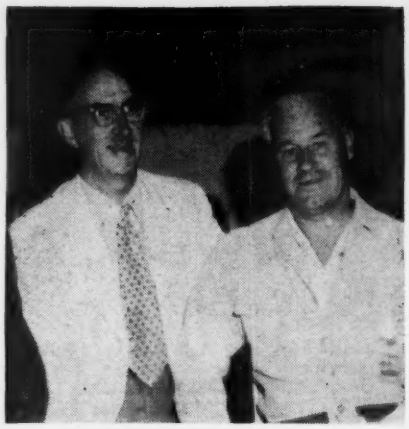


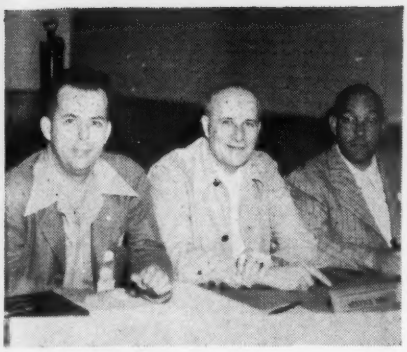
John Doris, John Doris, Inc., and L. C. MacNutt, MacNutt Electric Co., both of New York City.

H. E. Huff, Lamp Department, General Electric Co., Buffalo; H. A. Webster, T. Frederick Jackson, Inc., New York City, and Herbert Metz, Graybar Electric Co., New York City.

Robert E. Ginna, vice president, Rochester Gas & Electric Corp., Rochester, N. Y. He cited many cases of lighting jobs that had been done by electrical contractors in Rochester and stated that the lighting contracts ranged from $8500 to $39,000. He also pointed out that they have only scratched the surface, as about 95% of all stores and office lighting installations are still obsolete. Mr. Ginna said that fluorescent lighting is dominant, with some stores using a combination of incandescent and fluorescent. The lighting market is tremendous, and he urged the electrical contractors to do some creative selling to promote planned lighting.

Ernest R. Acker, president, Central Hudson Gas & Electric Corp., Poughkeepsie, N. Y., spoke on "The Electrical Industry Partnership—A Stocktaking". He reviewed American business, industry and the economic situation. He told what the utilities are doing to restore capacity to meet the largest industrial expansion program in all history.

"Streamlining the National Electrical Code Revision Program" was outlined by Charles L. Smith, secretary, National Electrical Code Com-



John P. O'Brien, Herbert G. Martin Co., Yonkers; A. A. A. Tuna, Tuna Electrical Co., Inc., New York City; and H. F. Janick, T. H. Green Electric Co., Rochester.

J. D. Lynett, New York Board of Fire Underwriters, New York City and Robert Archer-Shee, Continental Radiant Glass Heating Corp., New York City.

mittee, and secretary-treasurer of the International Association of Electrical Inspectors, Chicago, Ill. He reported on the last meeting of the Correlating Committee of the N.F.P.A. held in San Francisco on May 11. He said that the members of the committee discussed, adopted and recommended through proper channels a 1949 supplement to the National Electrical Code. This supplement has been forwarded to the American Standards Association for approval and released to the National Board of Fire Underwriters for circulation to all interested. He expects that in 1950 another supplement of the Code will be made available and every four or five years a complete revision of the Code will be made.

Mr. Smith explained how the code committee now operates. The committee consists of a small governing body, ten members, known as the Correlating Committee. There are 17 code making panels, with approximately 110 members serving on these panels. Proposals for changes are submitted to the panels and after study, report recommendations for code changes to the Correlating Committee, which reviews and approves them, seeing that they are reported to the Electrical Sections and then to the N.F.P.A. and A.S.A.

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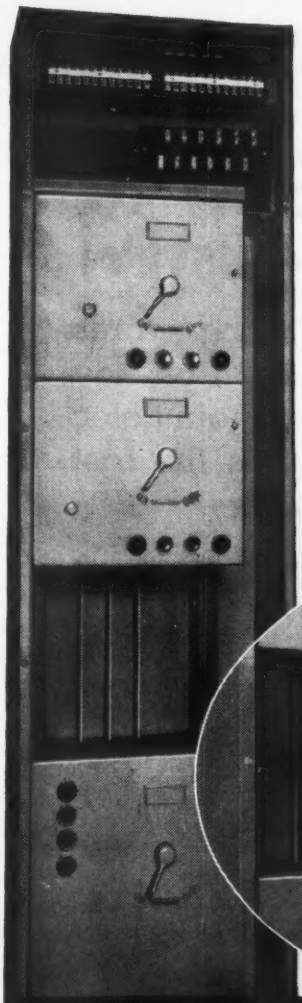

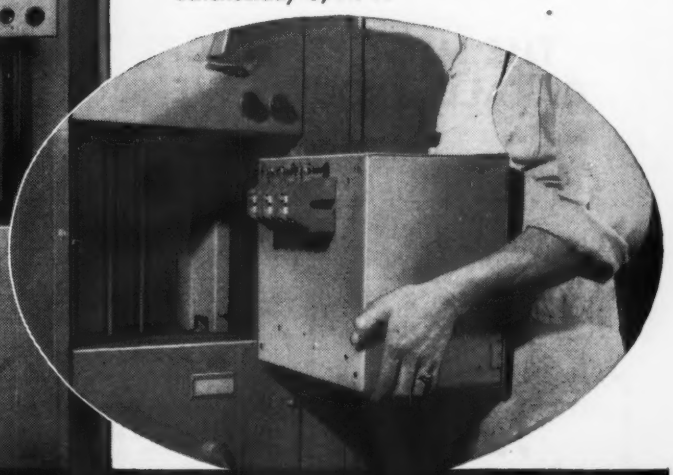

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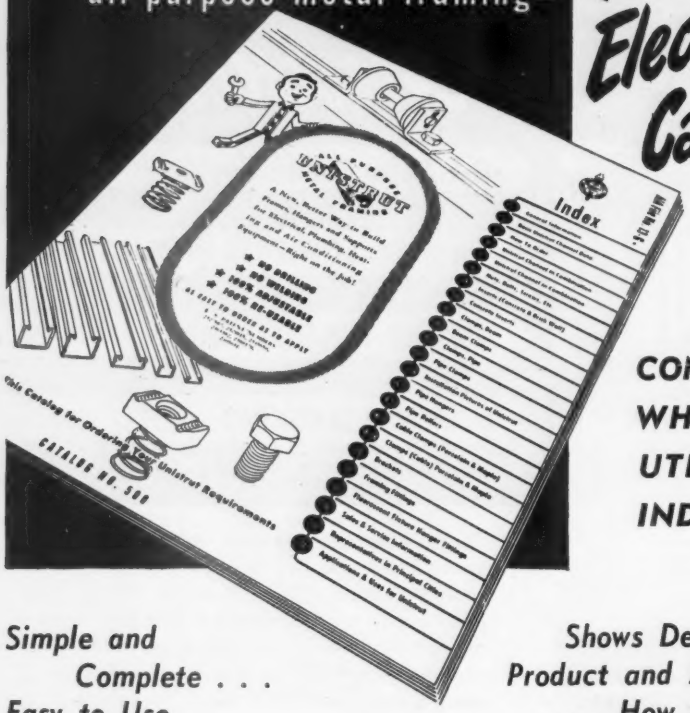

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N. J. MacDonald, Thomas & Betts Co., Elizabeth, N. J. and G. E. Wickman General Electric Co., Bridgeport.

Herbert Metz, eastern district manager, Graybar Electric Co., Inc., New York, was chairman of "Manufacturers and Wholesalers Day."

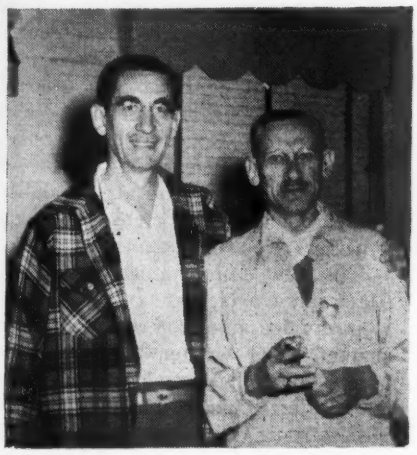
Alexander Fisher, President, Commercial Radio-Sound Corp., New York, spoke briefly on the television and industrial electronics market. He then introduced Alfred C. Lindquist, manager, Commercial Television Sales, RCA Victor Company, Camden, N. J. He outlined the rapid rise of this market in the last three years and said that it is now better than a billion dollar industry. The electrical contractor's part in the television industry consists of providing engineering services, selling, installing and maintaining equipment.

"The Electrical Contractor's Stake in Adequate Wiring" was the subject of the talk by N. J. MacDonald, vice president, Thomas & Betts Co., Elizabeth, N. J. He urged that the electrical contractors sell to the people the adequate wiring program—all the advantages of modern convenience and comfort from electrical living.

eral Electric Company, Bridgeport, Conn. urged that the contractors sell adequate wiring.

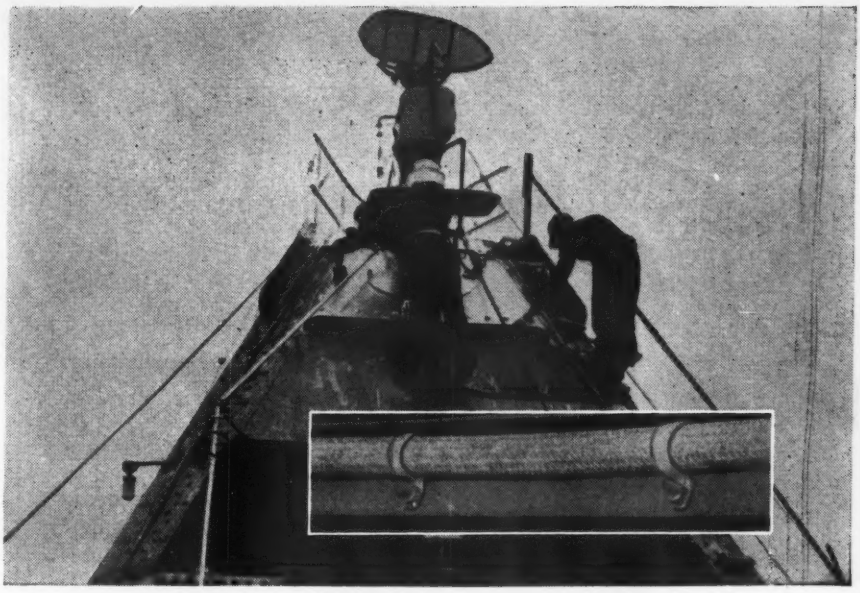
"Palomar's Peeping Tom" data relating to the new giant telescope was dramatically presented with a talk and slides by William R. McDonald, sales promotion division, Westinghouse Electric Corp., New York.

The following officers were elected for next year: president, Albert A. A. Tuna, New York City; 1st vice president, R. J. Knobloch, Syracuse, N. Y.; 2nd vice president, Efrem A. Kahn, Jamaica, N. Y.; treasurer, James F. Burns, Schenectady, N. Y.; secretary, H. F. Janick, Rochester, N. Y. A. Lincoln Bush, New York City and E. G. May, Albany, N. Y. were re-elected chairman of the board and vice chairman respectively. Directors elected for two years were E. G. May, Albany, William Aldrich, Nassau-Suffolk, L. W. Kieswetter, Syracuse, R. W. Mitchell, Buffalo.



Louis Lidsky, The L & P Electric Co., Brooklyn, N. Y. and S. M. Shor, Cole Electric Products Div., Federal Electric Products Co., Long Island City.

David Coyne, David Coyne & Company, New York City, and Louis Freed, Jandous Electric Construction Corp., New York City.



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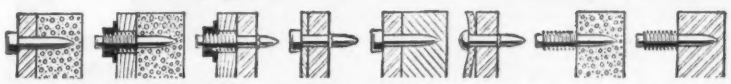

You can *"Ramset"* jobs like these easier, quicker, at far less cost than with ordinary methods. For a few fastenings or for thousands, RAMSET quickly repays the small first cost by doing the work faster and better.

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Let us give you a 15-minute demonstration of RAMSET and show you how other users reduce fastening costs up to 50% or more and finish installations faster—on time. No obligation—just mail the coupon. *Stemco Corporation, Cleveland 16, Ohio.*

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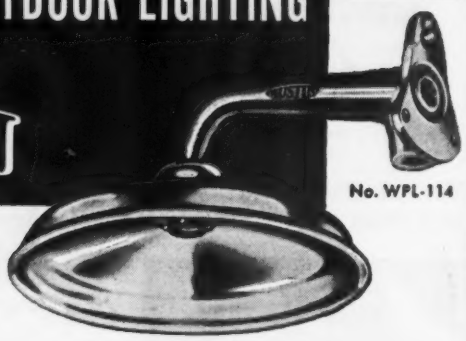

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The finest outdoor lighting fixture available, AUSTIN'S new WPL-114 consists of sturdy, rustless cast aluminum bracket and 14-inch heavy gauge steel reflector with baked porcelain enamel finish—green outside and white inside. Reflector rigidly mounted to fixture arm—can't vibrate or break loose. Bracket fitted with ½" conduit threaded hub in back and bottom. Keyhole slot in top of bracket for easy mounting.

AUSTIN No. SPB-12 YARD LIGHT
Straight bracket for pole or wall mounting —12" reflector. Also available with 14" reflector (No. SPB-14).

AUSTIN No. SWB-12 YARD LIGHT
Straight bracket with adjustable mounting flange—12" reflector. Also available with 14" reflector No. SWB-14).

All Austin yard lights come completely packaged with three lag screws, wire and Duxseal compound, ready to be wired and installed.

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Book Reviews

Maintenance Manual of Electronic Control

American industry's big job ahead is increased production per manhour. One of the major solutions to this problem is the adoption and increased application of industrial electronic control on the thousands of production lines from which roll the hundreds of thousands of items that now constitute the industrial life of the nation. Rapid strides have already been made in this direction over the past 15 years, and especially during the war years.

The rapid adoption and increased application of industrial electronic control created a demand for trained practical electronic technicians to install, maintain and service this equipment. It has also created a real demand for a practical installation, maintenance and service manual for these practical electrical and electronic technicians. The demand for the service manual has been met through the announcement of the first edition of the *Maintenance Manual of Electronic Control,* edited by Robert E. Miller, Weller Manufacturing Co., Easton, Pennsylvania, and written by a number of qualified engineers who are specialists in the various fields of electronics and industrial electronic control.

This new *Maintenance Manual of Electronic Control* contains 304 pages. It is divided into nine chapters, each chapter being written by a specialist on the subject material for that chapter. Subjects covered include "Circuits of Electronic Controls", "General Considerations in Installing and Maintaining Electronic Control", "The Cathode-ray Oscilloscope — What It Is, How to Use It", "Electronic Relays and Timing Relays", "Photoelectric Relays", "Electronic Motor Control", "Electronic Resistance Welding Control", "Electronic Temperature-control Systems" and "Sealed-ignitron Rectifiers". Special emphasis has been placed on the best methods and practices for installing, maintaining and servicing these various equipments and controls in every chapter.

Robert E. Miller, editor of this Manual, was formerly Industrial Editor, *Electrical Construction and Maintenance,* and later District Manager for *Electronics.* Having previously been for a number of years an industrial plant construction and maintenance electrician, he recognized the need for a manual of this type. He planned a series of articles and selected top engineers who were specialists in each type of equipment and could best and most authoritatively

handle each subject to write the material. The series which originally appeared in *Electrical Construction and Maintenance* was then prepared for this manual.

The contributors include: G. M. Chute, H. L. Palmer, E. D. Schneider, O. W. Livingston, E. B. McDowell, B. J. Dalton, W. J. Gorman, Jr., and L. W. Morton, all of the General Electric Company.

The Manual does not involve any mathematics. It is simply written and easily understood by the practical electrical or electronic technician. It is fully illustrated and contains sixteen separate check charts. It includes data on instruments and meters, with special treatment given to the cathode-ray oscilloscope—care and precautions in its use and how it can be adapted for special purposes.

Maintenance Manual of Electronic Control is clothbound, size 6 in. by 9 in., and is published by The McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York, 18, New York. Price is $4.50.

Power Switching Standards

Rating, manufacturing and application standards for bus supports and air switches; rating, performance and application standards for air interrupter switches; and application standards for outdoor substations are included in the NEMA Standards for Power Switching Equipment publication 49-144 which supersedes 45-94. All terms used in the publication are defined and instructions for the installation, operation and maintenance of power switching equipment are included. Priced at $2.75, the book is 67 pages of 8½-by-11 size and published by the National Electrical Manufacturers Association, 155 E 44th St., New York 7, N. Y.

Power Capacitors

Methods for determining the type and number of capacitors required on power circuits to correct given conditions of low power factor or voltage are thoroughly discussed and liberally illustrated in a new 205-page book titled "Power Capacitors" written by Ralph E. Marbury. Also included are such expositions as capacitor materials and characteristics, ratings, design and manufacturing problems, application of shunt capacitors to industrial power circuits, high-frequency and d-c units, fuses, switches and connec-

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tions used in conjunction with shunt capacitors, automatic controls, installation and maintenance. The book, written at the college level and planned for basic use by design and application engineers rather than to research and production engineers, is the first volume to be published in the newly established "Westinghouse-McGraw-Hill Engineering Books for Industry" series. The author, Mr. Marbury, is manager of the capacitor section of the switchgear distribution apparatus engineering department, switchgear and control division, and has had more than a quarter-century experience with his subject. Priced at $3.50, the book is published by the McGraw-Hill Book Company, Inc., New York.

Dates Ahead

International Association of Electrical Inspectors—Eastern Section, Hotel Statler, Boston, Mass., August 11-13; Western Section, Hotel Statler, St. Louis, Mo., September 26-28; Northwestern Section, Butte, Mont., October 3-5; Southwestern Section, Hotel San Diego, San Diego, Calif., October 10-12; Southern Section, Hotel Shamrock, Houston, Texas, October 17-19.

Illuminating Engineering Society—National Technical Conference, French Lick, Ind., September 19-23.

Pennsylvania Electric Association—Annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa., September 20-21.

National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., September 26-27.

International Municipal Signal Association—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., October 10-13.

National Safety Congress and Exposition—Chicago, Ill., October 24-28.

National Electrical Contractors Association—Annual convention, Rice Hotel, Houston, Texas, November 8-11.

National Electrical Manufacturers Association—Chalfonte-Haddon Hall, Atlantic City, N. J., November 13-18.

Sixth All-Industry Refrigeration & Air Conditioning Exposition—Atlantic City, N. J., November 14-18.

Plant Maintenance Show and Conference—Auditorium, Cleveland, Ohio, January 16-19.

American Society of Heating and Ventilating Engineers—Dallas, Texas, January 23-27.

Southwest Air Conditioning Exposition—Dallas, Texas, January 23-27.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 30-February 3.

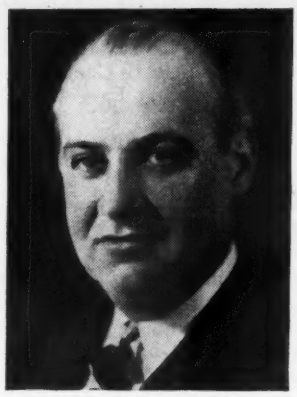
National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 13-16.

Manufacturers News

J. M. BENNAN NAMED PRESIDENT OF JEFFERSON

At the recent annual stockholders meeting of Jefferson Electric Company of Bellwood, Ill., the directors announced the appointment of James C. Daley, formerly president, to chairman of board; J. M. Bennan, president; John R. Ford, vice president and general sales manager; L. Mauerer, vice president in charge of engineering; W. S. Minter, treasurer; V. E. Lee, secretary.

The new president is a son of John



J. M. BENNAN

A. Bennan who, with James C. Daley, founded the Jefferson Electric Company in 1914 and who served as president from that time until 1943. J. M. Bennan who has been executive vice president, started with the company 16 years ago as a production control clerk.

GENERAL ELECTRIC CHANGES

A. E. Rowe has been appointed assistant manager of the ballast sales division of General Electric's specialty transformer and ballast divisions.

The following appointments in the Construction Materials Department, General Electric Co., Bridgeport, Conn. have been announced.

John A. Kelly has been named assistant to the manager of sales. Allan W. Macker has been appointed building project specialist and has been assigned to the Northeastern district and will make his headquarters at Boston. James D. Brown Jr., has been assigned to the Southwestern district with headquarters in Houston, Texas, and Clarence W. Ford has been sent to the Pacific District with headquarters at Los Angeles, both as building project specialists.

William L. Immer has been named a wire and cable specialist for the Central district. He will be located in the St. Louis office of the company at 3928 Lindell Blvd.

Raymond T. Lyons has been appointed operating manager of the Southwestern district warehouse and will make his headquarters at Huston, Texas.

Don C. McKinley, formerly in charge of air conditioning and refrigerator sales in the New York district, has been named a wire and cable specialist for the Southeastern District. He will make his headquarters in Atlanta, Ga.

All of the following have been named district representatives: J. Donald Rooney, north central district, with headquarters at Minneapolis; Eugene D. Britt, Jr., serving the Syracuse and Elmira, N. Y., wholesale trading areas and with offices in Syracuse; Leo J. Halkovich, serving the area of Johnstown and Altoona, Pa., with headquarters in Johnstown; John J. Myles in the Southeastern district, with headquarters at Jacksonville, Fla.; Robert

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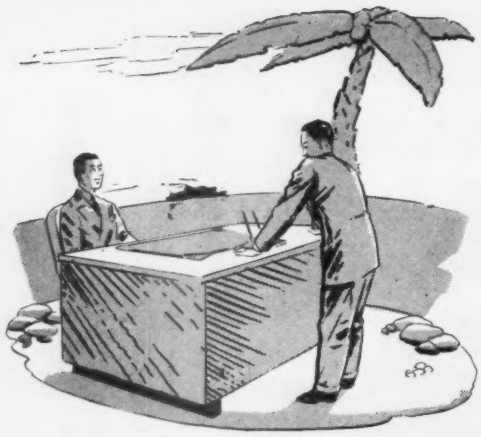

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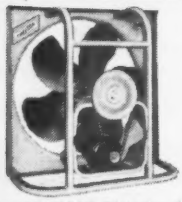
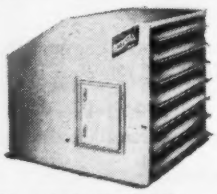
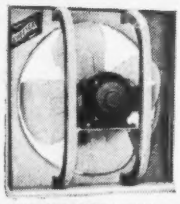


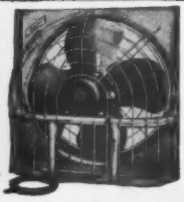
IND — EXHAUST FAN for factories, mills, mines, foundries, auditoriums. Belt drive. Sizes 24 to 60 inches.



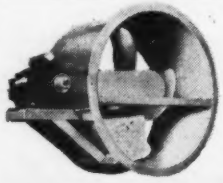
PH — ROOF VENTILATOR complete weather-tight unit for factories, mills. Belt drive. Sizes 24 to 60 inches.



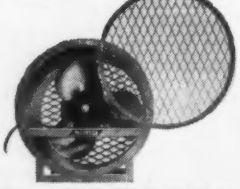
BB—ALL PURPOSE FAN moves large volumes of air. Direct drive. Sizes 12 to 30 inches.



AA—UTILITY FAN for equalizing heat or cold. Direct drive. Guard — front and back. Sizes 20 and 24 inches.



DXB—BOOSTER FAN for paint spray booths and removing fumes and heat. Belt drive. Sizes 16 to 36 inches.



DUB—HEAVY DUTY GENERAL EXHAUSTER. Screened. For steel mills, foundries, shops. Sizes 18 to 30 inches.

Write Dept. E-4 for industrial Bulletin No. 864 describing fan applications, fan uses and other pertinent information, and for catalog on Industrial Fans.

CHELSEA FAN & BLOWER CO., INC.
1206 GROVE STREET, IRVINGTON, NEW JERSEY

CHELSEA

CHARTER MEMBER OF THE PROPELLER FAN MANUFACTURERS' ASSN.

W. Johnson, serving New Haven, Waterbury and Hartford, Conn., with offices in New Haven; and Clinton J. Forstrom in the North Central District, with headquarters at Fargo, N. D.

BULLDOG ELECTRIC APPOINTMENT

The appointment of J. J. Mitchell, vice president, as chairman of the administrative committee, has been announced by BullDog Electric Products Company, Detroit, Mich.

In this capacity it is Mr. Mitchell's responsibility to coordinate all company divisional operations to obtain maximum overall efficiency and establish uniform company administrative policies and procedures. Mr. Mitchell will continue as head of the sales division and in addition, will have charge of all company public relations and commercial activities.

J. J. MITCHELL

SYLVANIA APPOINTMENTS

A Canadian subsidiary to manufacture fluorescent lamps and other lighting equipment has been formed by Sylvania Electric Products Inc. To be known as Sylvania Electric (Canada) Ltd., the new company has leased a plant from the city of Drummondville in the Province of Quebec.

F. J. Healy, becomes president of the new Canadian company; R. H. Bishop, vice president; William O'Keefe, secretary; and M. F. Balcom, treasurer. Mr. O'Keefe, who is general foreman at the Danvers, Mass. plant of Sylvania, will manage the Canadian plant, while J. C. Hicks, formerly Kansas City, Mo. division manager, has been named sales manager, with offices in Montreal.

Garlan Morse, formerly general merchandise manager for the Lamp Division of Sylvania Electric Products Inc., has been appointed director of Pacific Coast sales for all product divisions of the company. He will make his headquarters at the Sylvania Office in San Francisco.

Charles A. Burton, formerly assistant general sales manager of the Lamp Division of Sylvania, has been named

product sales manager. He will make his new headquarters at 60 Boston St., Salem, Mass.

Appointment of John C. Ringland and John D. Colombo to the Detroit Divisional offices of Sylvania has been announced. Mr. Ringland, previously associated with Kurt Versen Lighting Company, has been named a district engineer in the Detroit Division, while Mr. Colombo, who has been representing nationally known manufacturers for the past few years, becomes a field representative.

WESTINGHOUSE APPOINTMENTS

John K. Hodnette, vice president and general manager of industrial products for the Westinghouse Electric Corporation, Pittsburgh, Pa., has announced the appointment of three executives who will hold key responsibilities in the sale and engineering of such products.

The appointees and their new positions are: Tomlinson Fort, manager, apparatus sales department; William W. Sproul, sales manager, industrial products; and Royal C. Bergvall, engineering manager, industrial products.

R. L. Brown has recently been appointed by Westinghouse as division engineer in charge of engineering and development of instrument transformers, tap changers, and large power centers for its transformer division in Sharon, Pa. He succeeds J. H. Chiles, Jr., who has been made engineering manager for the entire transformer division.

ALLIS-CHALMERS CHANGES

New Allis-Chalmers electrical department appointments are E. E. Ellis, manager of the motor and generator section; V. J. Egan, engineer-in-charge, motor and generator sales, and H. H. Roth, engineer-in-charge of large generator sales group.

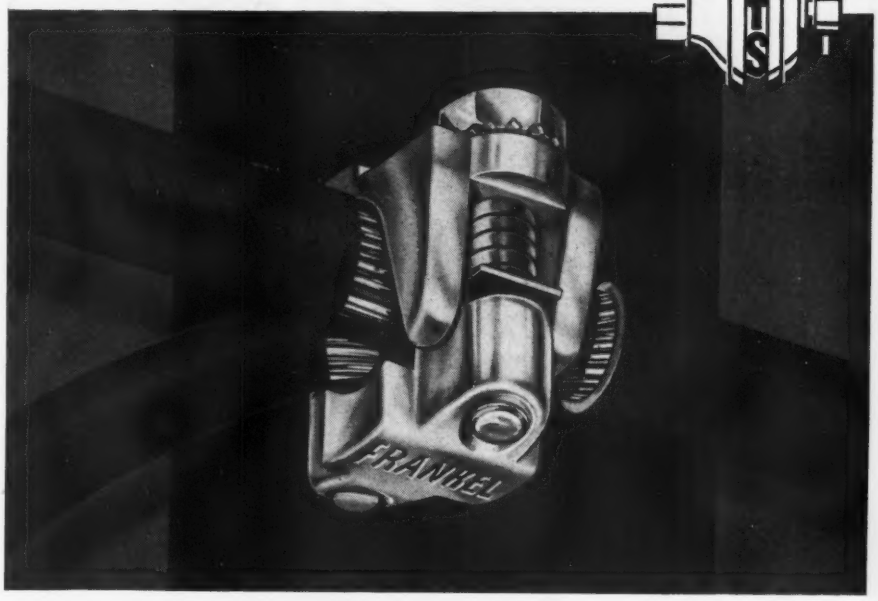
Ora F. Metz, district manager of Allis-Chalmers El Paso and Phoenix offices, has retired after nearly 43 years with the company. El Paso now becomes a branch office under Phoenix with John E. Despins as manager. W. C. Kinnon, who was manager of the Phoenix branch office, continues as manager of the new district office.

LITTELFUSE APPOINTS FIVE REPRESENTATIVES

Littelfuse, Inc., of Chicago, Ill. has announced the appointment of five new electronic sales representatives.

Two representatives have been named to serve the Greater New York area. Sydney H. Baum, 1800 Albemarle Road, Brooklyn, N. Y. will handle the electronic industrial accounts in this

put the screws on costs



with FRANKEL clip tap

cut original costs! Frankel Clip Taps cost you less . . . ⅓ to ½ less than "bug" type connectors in equivalent sizes!

reduce installation costs! Compact Frankel Clip Taps are speedier to install . . . only one small ordinary wrench is needed to tighten the standard hex head bolts instead of the oversize wrenches required to tighten the large nuts of split-bolt connectors. Faster, easier taping because of rounded edges and recessed bolts.

get these extra advantages! Frankel Clip Taps are the perfect connector for heavy duty service. Completely encircles and firmly forces conductors into high pressure contact. Lock washers keep it tight, always! No removable parts . . . no hardware to fall off in installation. Five sizes take all conductors from 2/0 to 1000 Mcm main with any size branch. Made of electrical bronze with non-corrosive Everdur bolts for extra strength.

Approved by Underwriters' Laboratories in all five sizes

Write today for descriptive sheet CT and price list.

SOLD THROUGH LEADING WHOLESALERS ONLY

Frankel Solderless Connectors

FRANKEL CONNECTOR CO.

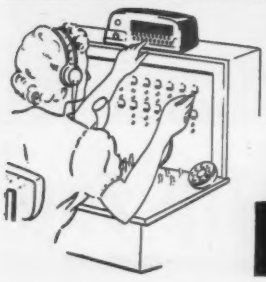
27 VESTRY ST. • NEW YORK 13, N. Y.

42 YEARS OF KNOW-HOW IN SOLDERLESS CONNECTORS

Don't LET WASTE-TIME RUN AWAY WITH YOUR PROFITS!

GET THE NEW Wheelock CODE CALL FOR INSTANT COMMUNICATION

Just Press a Button



Saves time and increases efficiency in your office and plant. Code Call is made by a numerical code, sounding signals. Promptly completes telephone connections with organization personnel away from their own telephones. Write for new Bulletin B4-3.

SIGNAL ENGINEERING and MANUFACTURING COMPANY
154 WEST 14th ST. • NEW YORK 11, N. Y.

"EFFICIENCY" DEVICES FOR CONDUIT and CABLE SUSPENSION

The "EFFICIENCY" CABLE STRAIN CLAMP

—withstands direct pull of 17,000 lbs.

Write for Catalog 38-A

Note These Features:
- Withstands direct pull of 17,000 lbs.
- Takes cable from 1/0 to 1,500,000 c.m.
- 3 clamp sizes cover all cable sizes.
- Furnished with eye or clevic
- For AC or DC service

• Without possible strain or damage, Efficiency Cable Strain Clamps are slipped over cable and tightened with U-bolts—locking cable safely and securely. H construction of clamp and high ridge across center of cable channel prevent cable from slipping. Write today.

Efficiency ELECTRIC AND MANUFACTURING CO. East Palestine, Ohio

area, while Jules J. Bressler, 220 W. 42nd Steet, New York, will service the electronic distributors and jobbers.

In Upper New York state, including all counties north of Westchester County, William F. Seeman, 248 Delaware Ave., Buffalo, N. Y., will cover electronic manufacturers and jobbers.

The Charles Segel Co., 143 Newbury St., Boston, Mass., is the electronic sales representative for both manufacturers and jobbers in the New England area, which includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island.

Eynon-Dakin Co., 1847 W. Bethune Ave., Detroit Mich. will service all electronic and automotive manufacturing accounts in the state of Michigan, and certain companies in Ohio.

BUCHANAN NAMES REPRESENTATIVES

Buchanan Electrical Products Corporation, Hillside, N. J. has announced the appointment of Felix Barnes, 686 Bruce St., Ridgefield, N. J. as sales representative in northern New Jersey and Staten Island.

F. O. Hoyt Company, 4 South 15th Street, Philadelphia, Pa. has been named sales representative in Delaware, Southern New Jersey and Eastern Pennsylvania.

William H. Caswen, 2320 North Florida Street, Arlington, Va. has been appointed sales representative in the District of Columbia and in the states of Maryland and Virginia.

•

Cutler-Hammer, Inc., has opened a sales office at 504 Broadway, Gary, Indiana. F. J. Burd will manage the office as a branch of the company's Chicago district sales office. H. Kolar, formerly in the electrical engineering department of the Carnegie-Illinois Steel Company's South Chicago Works, will assist Mr. Burd in handling the sales work in this territory.

•

The Weston Electrical Instrument Corporation of Newark, and its subsidiary, the C. J. Tagliabue Corp., N. J., have established a district sales office at 6230 Third Street, N. W., Washington, D. C., with Lawrence F. Parachini as district manager. This new office will serve the District of Columbia and adjacent counties.

•

Advance Transformer Company of Chicago, has announced the appointment of Charles D. White & Co., 589 Atlantic Ave., Boston, Mass. as agents in the New England states for the sales and distribution of fluorescent ballasts.

Fairbanks, Morse & Co., announces that T. M. Robie, who has for the past several years been manager of the company's Diesel division with headquarters in Chicago, has now been appointed director of quality control for the Beloit Works in Beloit, Wis. He has been succeeded by J. W. Wright who more recently was manager of the company's Diesel engine sales department at the Kansas City Branch.

•

Joseph di Palma, former plant manager of Kellems Co., announces the formation of the **Economy Cable Grip Company** of Saugatuck, Conn., manufacturers of pulling, lifting, and strain relieving devices.

•

E. W. P. Smith has been appointed director of merchandising of **Owens-Corning Fiberglas Corporation,** Toledo, Ohio. He was formerly vice president for sales of the Philip Carey Manufacturing Company.

•

The Hatfield Wire and Cable Co. has announced the appointment of Becker & Cane, Inc., 320 Broadway, New York, N. Y. as direct factory sales representative in the New York City area.

•

J. F. Wulfetange, Jr., 317 State St., Syracuse, N. Y. has been appointed eastern New York representative for the **Automatic Control Co.** of St. Paul, Minn.

•

The Kwikon Company of Chicago has announced the appointment of Curtis Sales Company, 4019 Prospect Ave., Cleveland, Ohio, as representative in northern Ohio and northern West Virginia.

•

Triad Transformer Manufacturing Company, Los Angeles, has named Ernest Clover to head the geophysical transformer division of the company.

•

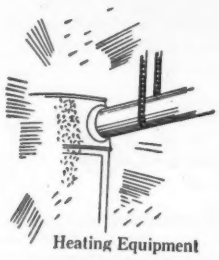
Warren S. Master has been appointed chief engineer of the **Richardson-Allen Corporation,** New York City.

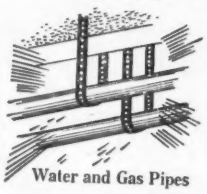
•

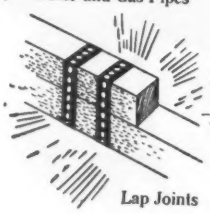
Virginia Welding Company, 114 Virginia Street, East, Charleston, W. Va., has been appointed distributor for **Hobart Brothers Co.**

THE BEST CRAFTSMEN ALWAYS TAKE PAINE'S...

TO SPEED CONSTRUCTION USE PAINE COILED HANGER IRON


Heating Equipment


Water and Gas Pipes


Lap Joints

Electrical Conduit

1001 USES ABOUT THE JOB

Everywhere you turn there's a job for Paine Hanger Iron that will help you to conserve labor and reduce your costs. This simple, yet amazingly versatile product can be bent or twisted to fit your exact needs. It can be used for hanging pipe, cable, conduit and numerous other items. It can be used for strengthening construction. Hanger Iron may be installed with nuts and bolts, screws or nails. It is ¾" wide and 20 gauge in 10′ zinc-plated coils. Perforated with holes for ¼" bolts on ½" centers. Reduce your construction costs —ask for Paine Coiled Hanger Iron from your supplier today.

THE PAINE COMPANY

2961 Carroll Avenue **Chicago 12, Illinois**

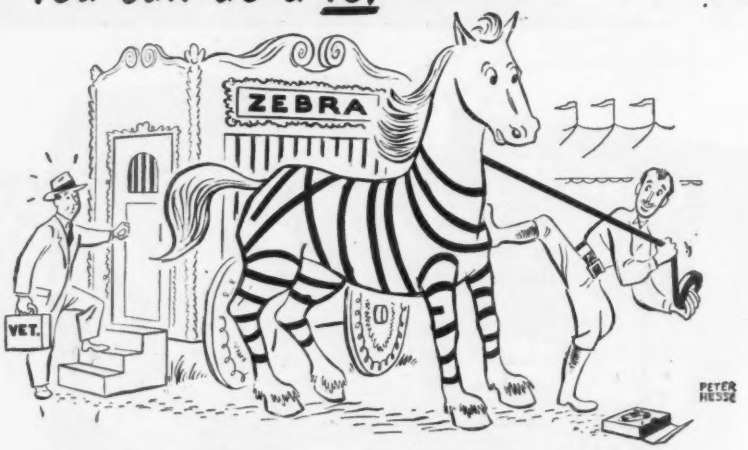
OTHER PAINE PRODUCTS

ANCHORS HANGERS Superior Feature BUILDERS SPECIALTIES

Spring Wing Toggle Bolts
Expansion Anchors
"Sudden Depth" Drills
Wood Screw Anchors
Pipe and Conduit Clamps and Straps
Hanger Iron, perforated
Expansion Shells
Star Drills
Malleable Shields
Special Hanging and Fastening Devices

WRITE FOR CATALOG

You can do a lot



with a little GOLD SEAL TAPE

There's more tape value in every roll because there's no waste. Gold Seal Tape *goes further.* And, rain or shine, you can depend on it to stick to the job . . . speed the work. Try Gold Seal Tape next time. In single rolls and handy 10-roll containers. Jenkins Bros. (Rubber Division), 80 White St., New York 13.

JENKINS Gold Seal Tape
FRICTION...RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

THE MAGNO-TRONIC
FLUORESCENT STARTER

PROTECTS — Fully, automatic thermal relay with unusually long life that eliminates blinking lights and protects all auxiliary equipment.

SIMPLIFIES — Replacement of worn-out lamp automatically restores closed circuit—replacement of starter unnecessary. No button to push.

REDUCES COSTS — Magno-Tronic starters provide exact timing in the lamp electrode—preheating process preventing excessive loss of emission material, thereby assuring the maximum in the useful life of a lamp. The established quality of this starter saves considerable time in maintenance and man hours required to repair and/or replace an inoperative lighting unit.

VERSATILE — Will operate efficiently over an extended voltage range under widely varying temperatures.

GUARANTEED FOR ONE YEAR.

The (SP-15-20) for use with either 15 or 20 watt lamps
The (SP-30-40) for use with either 30 or 40 watt lamps
The (SP-100) for use with 100 watt lamps

Ask for descriptive literature
INDUSTRIAL ELECTRONICS CORP.
MAIN PLANT Newark 2, N. J.

LOUVER CEILING RELIGHTS BANK (FROM PAGE 43)

cision to use light wood finishes for the paneling and trim, as well as light finished counter tops and deal plates. To blend with these and to provide a comfortable low ratio brightness contrast throughout, an asphalt tile floor of warm grey was selected.

The decision to use louverall lighting for the center area of the bank interior eliminated the necessity of a furred or finished ceiling. It also provided easy access to heating and ventilating ducts. As excellent shielding of the light source would result from the louverall pattern with two-inch square openings, it was only natural to select the then new slimline lamp to be operated at 300 ma. The desirability of instant-starting and ease of lamp replacement were other factors which influenced the selection of the slimline lamp.

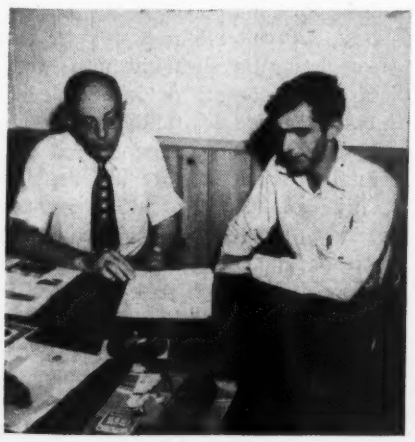
A final conference between the general contractor, the architect and the consulting architect, the electrical contractor and representatives of the bank resulted in complete agreement on the planned lighting system selected previously by some of the group as a result of the visit to the Nela Park Lighting Institute. It was decided to use the Vinylite plastic louvers made by Benjamin Electric Mfg. Company, known as "Sky-Glo", because of the overall light appearance resulting from the transmission of light through the vanes. At the same time, it was decided to adopt a similar louverall treatment for the entrance lobby leading into the banking area from the street. Continuous rows of slimline lamps were installed 18 inches above the louver cells on 24 inch spacings, on No. SL-96-3SR Pittsburgh Reflector Company slimline single lamp channels equipped with symmetrical reflectors of baked white enamel finish. The lamps selected were 3500-degree white, and were operated at 300 ma. After operating for three months the lighting intensity in the public area under the louverall lighting averaged 90 footcandles.

In the tellers' and officers' work area, three continuous rows of recessed troffers, spaced on five-foot centers, were installed in a U-pattern. These troffers, Miller Company Tulamp type, were equipped with Albalite glass closures, and lamped with standard 3500-degree white 40-watt fluorescent lamps. The lighting intensity after three months averaged 60 footcandles under the troffer lighting system.

Contributing to the satisfactory lighting results and the pleasing atmosphere were the finishes, colors and balanced ratio between the reflection factors of the various surfaces. The ceiling is of Sanicoustic tile with a 75 percent RF. The walls are finished in a mat soft blue-green, with 35 percent RF. The tellers' counters and deal plates are mottled light green Formica, with 36 percent RF. Wood paneling and trim are bleached American walnut, with 34 percent RF. Floors are asphalt tile, four-in-one pattern of warm grey, with 34 percent RF. Carpets are grey figured pattern, with 30 percent RF.

The total connected lighting load is 20,680 watts, of which 6,930 watts is in the public area and 13,750 watts is in the tellers' work area.

The consulting architect for this project was Aaron Alexander, New York City, and the architect was Carl R. Traver, Rochester, N. Y. John B. Pike & Son, Inc., Rochester, N. Y. were the general contractors and T. H. Green Electric Co. of Rochester, N. Y. were the electrical contractors. All cooperated in the planning and execution of the Planned Lighting installation, and are well pleased with not only the lighting result, but also the warm, cheerful atmosphere and harmonious decorating treatment achieved through the careful selection of the lighting system, colors, finishes and reflection factors for all surfaces. It is believed that "the new look" created here will contribute in some measure to a new trend in bank lighting and decoration. This installation is truly the nucleus of an adequately lighted banking room, a simple design lighting system and a friendly atmosphere.

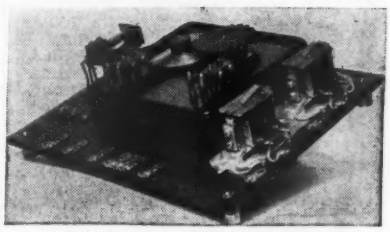


Father and son combination at Giles Armature & Electric Works, Inc., Marion, Illinois. John E. Giles (left) is vice-president and son Robert A., foreman of the coil department. Among Giles customers are more than 100 coal mines in southern Illinois area.

ELECTRICAL SPECIALTY ITEMS FROM CANNON ELECTRIC

Fire Alarm Station

FIRE ALARM BOX—Combination Open and Closed Circuits. Install the Cannon "Break Glass" Fire Alarm Station and prevent false alarms caused by unintentional leaning or pushing against centrally located suspended hammer-type alarms. Type FA-105C fits any standard single gang outlet box; also available with sub-base adapter for surface mounting. Best suited to smaller fire alarm installations.

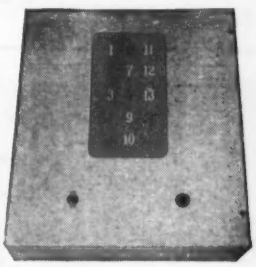


Code Signal Relay

FIRE ALARM RELAY—Motor-Driven Type. Type FA-102M California Uniform Code consists of a code ringer which sounds the signal, and includes a common base, motor and contact making device. Motor operates at 24V or 115V A. C. continuously as long as control circuit is energized. Sturdy in construction and ample power to insure uniform spacing and duration of signal.

Lamp Annunciators

for all types of silent visual signaling in factories, institutions and offices. Made in combinations from four up to a hundred or more lamps. Each annunciator is equipped with intermittent soft tone buzzer, thermostatically controlled. Steel cabinet construction with various finishes available. Lamp change simplified with hinged door design. Identified as the HNA series.



Conduit Fittings Prices Reduced

CNT-1U BOX CONNECTOR (shown above) is listed as approved by Underwriters' Laboratories. ⅜" reversible type for BX and Romex flexible metallic conduit. Aluminum Alloy; zinc clamp. Completely assembled with slot head screws. Standard package, 1000 pieces; carton, 100 pieces.

CF-1U-½ and CF-2U-¾ are listed as approved by Underwriters' Laboratories. For ½" and ¾" flexible metallic conduit. Aluminum alloy. Inspected, assembled and packaged. Standard package 1000. All Cannon Conduit Fittings F. O. B. destination on quantities of 100 lbs. or more. Less than 100 lbs. F. O. B. Los Angeles.

★ *Write for FA-1 Alarm and Relay Bulletin; CF-7 for Conduit Fittings, and H-2 for Annunciators. . . . . Address Department H-231.*

SINCE 1915

CANNON ELECTRIC

Development Company 3209 HUMBOLDT ST., LOS ANGELES 31, CALIF.

World Export: Frazar & Hansen, San Francisco. Canadian plant: Cannon Electric Co., Ltd., Toronto

That *Extra* Reinforcing Thread Plate Assures Connections That Are Stronger And Last Longer

Sherman "Wedge-Grip" Connector

Examine the above illustration, and you'll see that the screw in the Sherman Wedge - Grip Connector passes through *two* thicknesses of metal. The extra insert plate you see is a patented feature which *doubles* the thread strength — enables you to make connections that are twice as tight — twice as permanent.

Try the Wedge - Grip today. It's today's finest Solderless Connector for all small wire connections.

H. B. SHERMAN MFG. CO

Battle Creek, Mich.

Sizes and Specifications

Part No.	Minimum Capacity	Maximum Capacity
SC-12X	2-20 Solid	2-12 Solid
SC- 6X	2-12 Solid	2-6 Strand
SC- 6	2-12 Solid	2-6 Strand
SC- 4X	2-8 Solid	2-4 Strand
SC- 2X	2-4 Solid	2-2 Strand

Part No.	Type Screw	Carton Quantity
SC-12X	Hex Head	200
SC- 6X	Hex Head	100
SC- 6	Plain Head	100
SC- 4X	Hex Head	100
SC- 2X	Hex Head	50

***Sherman* "Wedge-Grip" Connectors**

Designed for your need — the new

TAL E.M.T. Bender

pays for itself in the time that it saves.

Also attachable to Tal 2" or 3" Pipe or Conduit Benders.

Think what you can do with this new portable machine that bends all types of thin-walled tubing on the spot:

- free from kinks
- free from wrinkles
- no shifting of tubing
- easy to operate
- less than one minute required to make any bend in one single setting

Anyone can handle this machine — even inexperienced labor — and do in seconds work that requires minutes with other equipment. It comes packed in a handy tool box — and because the frame, formers and bars are made of a lightweight alloy, one man can carry it easily.

Write today for full information.

TAL Bender, Inc. Dept. 21 **Milwaukee 2, Wis.**

EXPLOSION-PROOF WIRING

[FROM PAGE 45]

47-kws. of the 120-kw. total consists of such fixtures. Specifically, in areas devoted to drum storage, solution compounding, bottle goods and powder packaging, vapor-proof shallow-dome units, with 200- and 300-watt incandescent lamps, are installed. Vapor-tight units with wire guards are used in the basement cool storage area, and vapor-proof luminaires with prismatic globes are installed throughout the liquid packaging area and certain sections of the bottle goods storage room. Vapor-proof units also include fluorescent fixtures, for luminaires over the benches in the liquid packaging section are gasketed with hinged clear-glass covers. Explosion-proof standard dome reflectors with globe and guard surrounding 300-watt incandescent lamps are installed in wash rooms and, in these areas, wiring is also explosion-proof with conduits sealed at switches and at room entrance points.

Lighting in areas other than hazardous locations includes prismatic glass pendant type Holophane units, ceiling mounted fixtures of similar design, and recessed 2-lamp troffer fluorescent luminaires with prismatic glass bottom panels. All fluorescent fixtures are equipped with high power-factor ballasts and either No-Blink or Watchdog starters.

Floor ducts, consisting of dual raceways for telephone and 120-volt receptacles, serve the entire office area.

Motors in the industrial areas are totally enclosed, with single pole switches controlling 120-volt single-phase units and 2-pole switches installed for both single-phase and 3-phase 220-volt motors.

Completing the electrical installation picture are control devices and the necessary wiring for unit heaters, elevators, air conditioning apparatus, ventilating fans and fire alarms.

This new 2-story and basement structure, covering approximately ½-acre of land, is the 72nd building to be erected on The Guardian Corporation property. Of steel frame construction with masonry walls and partitions, the building includes both commercial and industrial areas.

Designed and constructed by the Wigton-Abbott Corporation of Plainfield, New Jersey, who were engineer-contractors for the entire project, the building was electrically completed by the Watson-Flagg Engineering Company of Paterson, N. J.

SOUND POWERED TELEPHONE SYSTEMS

[FROM PAGE 47]

signal any outlying station in the system. Any outlying station may signal the switchboard. The switchboard may call and interconnect two outlying stations. Normally as many conversations as there are pairs of cross-connecting cords may be held at one time. A conference feature may be added if desired.

The number of telephones which may be connected in the intercommunicating type of system is largely dependent upon the (1) number of points or connections on the selector switches, (2) the number of persons using the system, (3) the number of conversations which may take place at one time. There is no appreciable decrease in reception volume with increased number of instruments connected and used at one time.

In general all instruments should be properly installed and located or mounted within easy reach of the user. The place chosen should preferably be as quiet as possible, and remote from noisy machinery. Interior type telephones should be located where they will be free from dampness. Many types are available in cast iron, aluminum or bronze cases which are gasketed, weatherproof and splashproof to meet practically any condition.

A sound powered telephone of the marine type manufactured by the Hose McCann Telephone Company is shown in Figure 3. This unit is splashproof for service in a wheelhouse, radio room or other inside location. The case is made of cast aluminum with a gasketed cover and is practically watertight for use in damp places. A ringer consisting of two 2½ inch gong shells is mounted directly behind a watertight sound screen. The handset is of the standard type having a molded case and having attached thereto a molded rubber cord, however, a watertight handset can be supplied for special applications. The selector switch for connecting to other telephones in the system is shown at the top and center. The crank which actuates the magneto-generator in the interior of the case protrudes through the lower right hand side of the case. Four mounting lugs are used for fastening to bulkheads, decks and walls.

A sound powered telephone of the interior type manufactured by the Wheeler Insulated Wire Company is shown in Figure 4. This unit is designed for two station service and may

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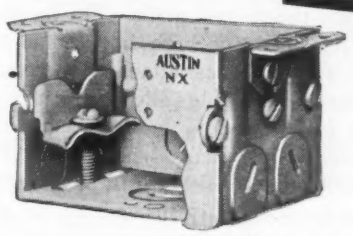
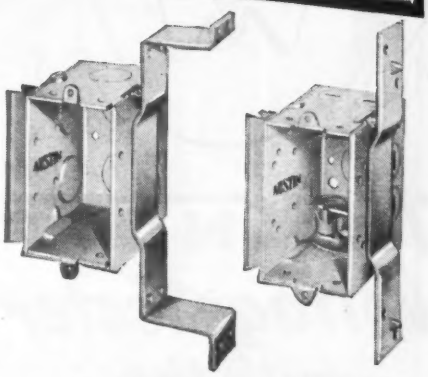
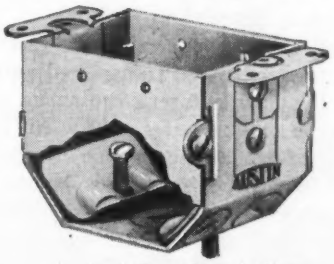


Austin Type NX Box for Non-metallic Sheathed Cable. U. S. Pat. No. 2,348,318.



Austin Type CMBR Box shown with BR Universal Mounting Bracket.

Austin Type BXFA-N Box shown with Type A Side Mounting Bracket.



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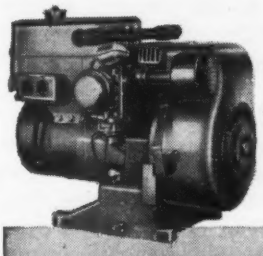

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be used in homes, offices, farms and many other places. All frame parts are rust and corrosion proofed and the coils in the telephone handset and the generator ringer system are impregnated to insure satisfactory performance even in installations where some moisture is prevalent. A ringer having a single gong shell with its associated bell crank assembly is mounted behind the molded grille. The handset is also made of high impact molded material and has attached thereto a neoprene retractile coiled cord. A button for calling is located below the grille. On systems where a number of other telephones are to be called, a selector switch is located on an extended molded headpiece above the grille. A mounting plate is provided with each unit and the front section is fastened to same.

The range over which the talking and ringing may be transmitted varies with the manufacturer's equipment and the type of line wires used. An important factor is the amount of capacitance in the lines and this is dependent upon its condition, insulation, whether wet or dry, and whether run on the ground or in the air. Under normal conditions they will operate over a distance of 20 to 30 miles.

The wiring for the average installation in a home, office, business or industrial plant having lines up to a distance of approximately three miles may consist of No. 22 B & S gauge conductors. For long runs the size of the wire must be increased to No. 19 or No. 16 B & S gauge and perhaps even larger depending upon conditions, and tensile strength requirements and as recommended by the manufacturer.

Where cables are used, the standard hard surface braided flameproof type may be installed in dry indoor installations. Lead-covered cable should be used in damp or wet locations.

Full metallic systems are recommended for the best results. Grounded return systems are occasionally used, however, the results obtained are dependent entirely upon the type of ground connection, soil condition and its mineral and moisture content. Twisted conductors are deemed preferable for the transmission lines. Some systems require a pair of twisted wires for each station of the selective ringing type, while others only require one wire for each station but the manufacturers recommend that a twisted pair be used for each pair of stations.

Where wires are run out-of-doors, it is recommended that a proper lightning arrestor be installed, securely grounded, and that weatherproof wire be used. For long distance runs where

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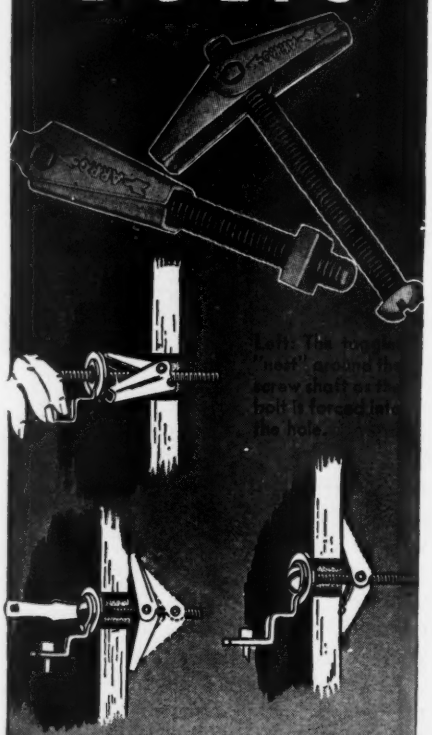

Above: The toggles spring back in position to form a bearing against the back wall.

Above: The toggle screw is screwed tightly into a solid position.

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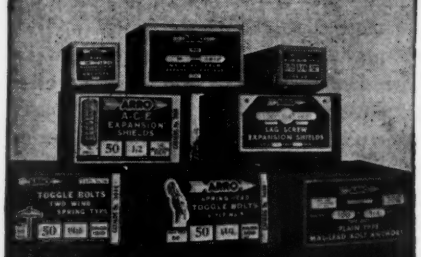

ARRO EXPANSION BOLT COMPANY
MARION, OHIO

single conductors are installed on poles they should be mounted on brackets and fastened to insulators. The conductors should be spaced approximately 12 inches. For long distance runs where lead-covered cable is used and is to be installed on poles, they should be properly supported on messenger cable. For short distances where single conductors are installed, No. 16 B & S gauge twisted pair hard-drawn plastic insulated wire has been found very satisfactory since it has the extra tensile strength for outdoor installations.

No shielding or special protection is required on the outdoor installations other than to prevent their contact with light and power lines.

A partial wiring diagram of a Hose McCann sound powered marine telephone system is shown in Fig. 2. A riser diagram of this system in a more complete form is shown in Fig. 1. While ten stations are shown, there are actually two stations connected on switch contact No. 1 in the wheelhouse and on top of the wheelhouse. The telephones are wired for selective ringing and common talking. The engine room telephone is provided with a double pole single throw relay with the coil connected in multiple with the telephone bell. The contacts of the relay are connected to a battery or to the ship's current and also to a horn or howler. The selector switch on the front of the telephone is turned to the desired station indication and the crank of the magneto-generator is rotated and causes the bell at the called station to ring. Pressing the button on the handset completes the talking circuit from one station to the other.

John H. McGlinsey, vice-president, L. R. Klose Electric Company, Kalamazoo, Mich., proudly exhibits the multi-voltage, multi-phase test dynamometer board he designed for their motor repair division.

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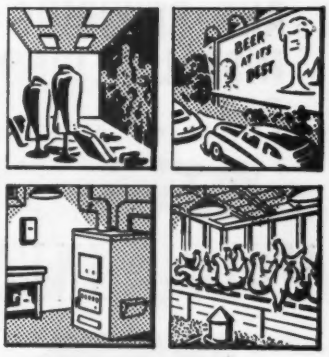

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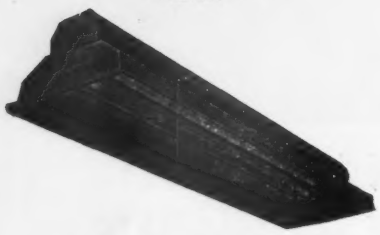

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TELEVISION

[FROM PAGE 38]

dual purpose of facilitating cable pulling and supporting the cables as well, with hollow-cone split-fiber wedges gripping the cables at these intermediate points.

The coaxial lines (four in number) measure 3½-inches in diameter and are carried up the southwest tower leg. Two of these cables rise to the six-bay turnstile television antenna, a third line runs to the single-bay circular FM antenna, while the fourth line is terminated at the micro-wave relay station.

To eliminate the hazard of falling ice and to reduce the possibility of impaired transmission during freezing weather, each antenna bay is heated by an induction ice melter, consisting of 230-volt Calroid resistors, ground-controlled by a 3-pole double throw 60-amp. switch located in the transmitter building's utility room, and doubly protected against current failure by a 10-kw. 3-phase 208-volt stand-by alternator.

Mobile Telecruisers

At present, the majority of WOR's programs are originating in the studios of New York City's recently-completed Television Center, and are carried to the North Bergen transmitter over telephone cables caried beneath the Hudson River through the Lincoln midtown tunnel.

Television programs not originating in these studios are transmitted by micro wave from the previously-mentioned mobile units to the station's tower-borne microwave relay. These mobile telecruisers, in addition to carrying cameras, microphones, amplifiers and microwave transmitters, are equipped with radio telephones, permitting the driver or operating technicians to communicate with the transmitter or studio while making on-the-spot broadcasts.

All the telecruiser's equipment is shock mounted, including audio, video and a-c wiring. On the roof are three tripod mounts, one of which supports the parabolic reflector for relay back to the main transmitter, the master control, or the main studio.

Programs, when received at the station, are sent over the air by a 5-kw. visual transmitter and a 2.5-kw. aural transmitter, both units being General Electric Type 6B. Output of the TV transmitters is combined in a diplexer unit which feeds pictures and sound simultaneously to the broadcasting antenna.

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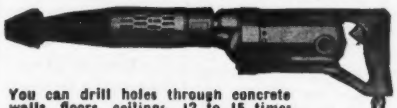

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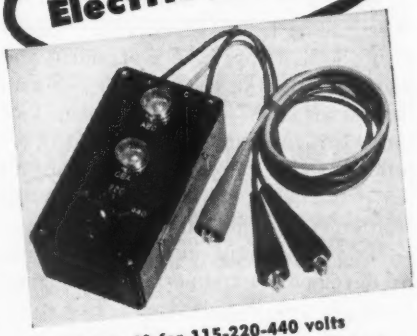

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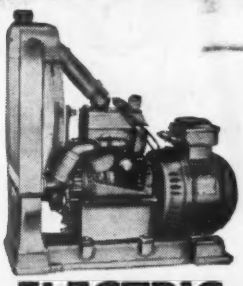

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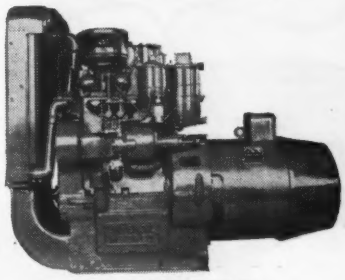

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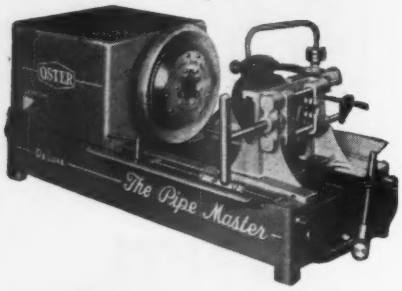

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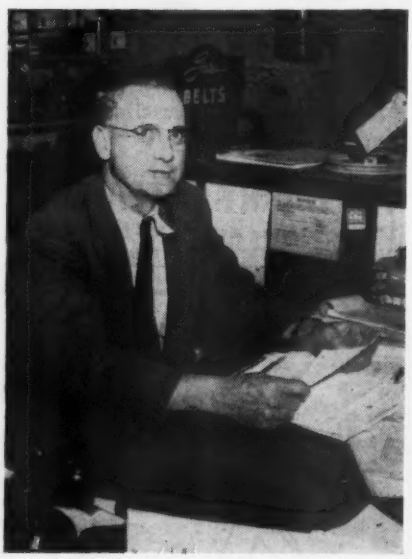
Television, still in its early stages of development and perfection, is being both blessed and damned. For overnight it has changed our habits concerning movies, home entertainment, sports, radio, reading and even conversation. Delayed in its development by two wars, jurisdictional differences, the questions of color and ultra high frequencies, limited technical know-how, high costs and hesitant sponsors, the industry nevertheless has grown rapidly from a gangling youngster to a strapping giant. It still has growing pains—but make no mistake about the fact that it is the latest wonder of our age; and it's here to stay.

This industry, predicted to be headed towards the $6-billion mark within a few short years, is the latest plum in the electrical industry's pie. The fact that television is only beginning to grow holds a bright promise for those who promote it in the fields of production, distribution, construction and installation.



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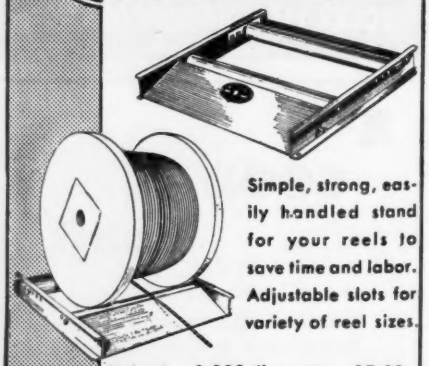

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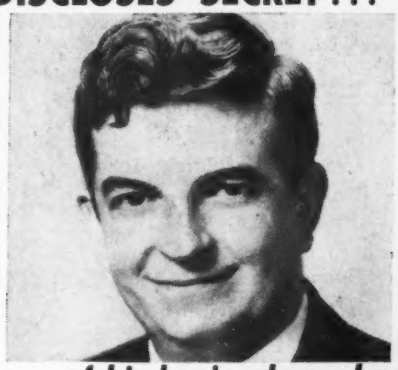

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